Principles of ERCP: papilla cannulation, indications/contraindications and risks

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Evolution of ERCP


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1970s ECPG—Endoscopic CholangioPancreatoGraphy

Japan → Europe (appropriate long side-viewing instruments by Olympus)

1974 Biliary sphincterotomy
1979 Biliary stenting

mid1970s serious adverse events (3%, death 0.2%) pancreatitis, cholangitis, sepsis, instrumental injury to the GI tract, drug reactions; procedure failure rate 30%

1980/90s «golden age» endoscopic management of duct stones and tumours easier, cheaper and safer than surgery

Since 2000 no diagnostic ERCP (scanning radiology, EUS), extending the indications of therapeutic ERCP (pancreatitis, Oddi dysfunction?), combination with other techniques (PTCD, EUS-guided puncture of CBD), quality improvement, patient empowerment

Anatomy of the papilla of Vater

Variations in union of bile and pancreatic ducts

- Short common channel
- No common channel
- Long common channel
Cannulation of the papilla of Vater

Tucked under position

Proper cannulation angle

Bile duct cannulation
Tightening the cutting wire bows the tip of the cannula upward (cephaled orientation)

Lifting the cannula increases the likelihood of entry into the BD
Cannulation of the papilla of Vater

1. orifice
2. frenulum
3. hood
4. infundibulum
Cannulation of the papilla can be challenging…

Definition of difficult biliary cannulation:

- > 5 attempts
- > 5 minutes
- > 1 cannulation of the pancreatic duct

Cannulation techniques:

1. Guidewire – catheter is inserted into the papillary orifice, guidewire advanced under fluoroscopy/guidewire is advanced 1-2 mm beyond the tip of the catheter and directly pushed into the orifice

2. Contrast – definition of the anatomy by injection of a small volume of contrast

3. mixed

4. Pancreatic guidewire technique (double guidewire)

5. Conventional precut (stepwise incision of the mucosa by a needle-knife with mixed current starting at the upper margin of the orifice in the direction of the bile duct)

6. Fistulotomy (stepwise incision of the mucosa directly over the roof of the papilla followed by up/downward cut

7. transpancreatic sphincterotomy (guide wire in the pancreatic duct, precut directed towards the bile duct)

8. Anterograde guidewire insertion (percutaneous or EUS-guided puncture of the CBD)
Indications for ERCP

1. Stone disease (jaundice, biliary pain, cholangitis, biliary pancreatitis, pancreatic duct stones)
   
   ES + stone extraction (balloon, wire basket w/ or w/o lithotripsy)

2. Ampullary/periampullary abnormalities (SOD, ampullary cancer)
   
   ES ± stenting, ampullectomy

3. Biliary or pancreatic ductal abnormalities (leaks, strictures, malignancies)
   
   stenting (plastic, SEMS), diagnosis (brushing, biopsies, lavage, cholangioscopy),
   dilatation (Bougie, balloon), ablation techniques (e.g. endobiliary RFA)

Contrandications for ERCP

Relative contraindications

1. Portal hypertension with esophageal and/or gastric varices
2. Acute pancreatitis except biliary pancreatitis
3. Recent myocardial infarction and/or severe cardiopulmonary disease (unless ERCP is life-saving)
4. Repeated failed attempts at ERCP therapy when alternatives are available
5. Anaphylactic reaction to radiographic contrast

Absolute contraindications

1. Pharyngeal/esophageal/pyloric/duodenal obstruction (unless these can be treated simultaneously)
2. Altered anatomy (Roux-en-Y, Billroth II, pancreaticoduodenectomy) w/o necessary skills or tools
3. Severe uncorrected coagulopathy
4. Known or suspected perforation
5. Consent cannot be obtained, unless deemed an emergency
6. Inadequate indication, the risk of the procedure outweigh the potential benefits
Post-ERCP complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Overall incidence</th>
<th>severe</th>
<th>mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute pancreatitis</td>
<td>1-7%</td>
<td>0.4%</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Post- ES bleeding</td>
<td>1-2% (up to 10%)</td>
<td>0.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Acute cholangitis</td>
<td>1%</td>
<td>0.1%</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Acute cholecystitis</td>
<td>0.2-0.5%</td>
<td>0.1%</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>perforations</td>
<td>0.3-0.6%</td>
<td>0.2%</td>
<td>&lt;0.1%</td>
</tr>
</tbody>
</table>
Post-ERCP complications – Acute pancreatitis

<table>
<thead>
<tr>
<th>Patient-related risk factors</th>
<th>Procedure-related risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definite risk factors</strong></td>
<td><strong>Definite risk factors</strong></td>
</tr>
<tr>
<td>Suspected sphincter of Oddi dysfunction (SOD)</td>
<td>Cannulation attempts duration</td>
</tr>
<tr>
<td></td>
<td>&gt;10 minutes(^2)</td>
</tr>
<tr>
<td>Female gender</td>
<td>Pancreatic guidewire passages &gt; 1</td>
</tr>
<tr>
<td></td>
<td>2.77 (1.79 – 4.30)</td>
</tr>
<tr>
<td>Previous pancreatitis</td>
<td>Pancreatic injection</td>
</tr>
<tr>
<td></td>
<td>2.2 (1.60 – 3.01)</td>
</tr>
<tr>
<td><strong>Likely risk factors</strong></td>
<td><strong>Likely risk factors</strong></td>
</tr>
<tr>
<td>Previous PEP</td>
<td>Precut sphincterotomy(^3)</td>
</tr>
<tr>
<td></td>
<td>2.3 (1.4 – 3.7)</td>
</tr>
<tr>
<td>Younger age</td>
<td>Pancreatic sphincterotomy</td>
</tr>
<tr>
<td></td>
<td>3.07 (1.64 – 5.75)</td>
</tr>
<tr>
<td>Nondilated extrahepatic bile ducts</td>
<td>Biliary balloon sphincter dilation</td>
</tr>
<tr>
<td></td>
<td>4.51 (1.51 – 13.46)</td>
</tr>
<tr>
<td>Absence of chronic pancreatitis</td>
<td>Failure to clear bile duct stones</td>
</tr>
<tr>
<td></td>
<td>3.35 (1.33 – 9.10)</td>
</tr>
<tr>
<td>Normal serum bilirubin</td>
<td>Intraductal ultrasound (IDUS)(^4)</td>
</tr>
<tr>
<td></td>
<td>2.41 (1.33 – 4.39)</td>
</tr>
</tbody>
</table>

\(^2\) Risk estimates adjusted for sex, age and body mass index

\(^3\) Risk estimates adjusted for number of previous sphincterotomies

\(^4\) Risk estimates adjusted for number of previous procedures
Post-ERCP complications – Acute pancreatitis

How to avoid PEP?

1. prefer guidewire-assisted cannulation to contrast injection
2. prefer needle-knife fistulotomy to precutting of the papilla

3. pancreatic duct contrast injection
   - avoid multiple injections
   - avoid high pressure injection («acinarization»)
   - prefer non-ionic contrast
   - train the assistant

4. Thermal injury during ES
   - bipolar current safer than monopolar
   - HF current generator (Endocut mode, ERBE)

5. Pharmacologic prevention

6. Pancreatic stents
   - high risk for PEP
   - in case of endoscopic precutting
   - «double» (biliary and pancreatic) guide-wire cannulation
   - use 5 Fr are more efficient than 3 Fr for min. 12-24 hours
   - passage of the stent should be evaluated in 7-10 days
Post-ERCP complications –Bleedings

1. Intraluminal
2. Intraductal
3. Hematomas (hepatic, splenic, intraabdominal)

Risk factors for post-sphincterotomy bleeding:

<table>
<thead>
<tr>
<th>Definite (Multivariate analysis)</th>
<th>Possible (Univariate analysis)</th>
<th>No risk factor (Multivariate analysis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulopathy</td>
<td>Liver cirrhosis</td>
<td>Aspirin</td>
</tr>
<tr>
<td>Anticoagulation within 3 days of ES</td>
<td>Dilated CDB</td>
<td>NSAID</td>
</tr>
<tr>
<td>Acute cholangitis before ERCP</td>
<td>Periampullary diverticulum</td>
<td>Ampullary tumour</td>
</tr>
<tr>
<td>Bleeding during ES</td>
<td>Precut</td>
<td>Length of ES</td>
</tr>
<tr>
<td>Low case volumen</td>
<td>CDB stone</td>
<td>Extension of prior sphincterotomy</td>
</tr>
</tbody>
</table>
Post-ERCP complications – Post-ES bleeding

2. Tc-hemmer****

Niedrig-Risiko Eingriff
- Gastrokopie ± Biopsie
- Kolonoskopie ± Biopsie
- ERCP (diagnostisch, Stent)
- EUS
- Enteroskopie

Hoch-Risiko Eingriff
- Gastrokopie mit Polypektomie
- Kolonoskopie mit Polypektomie*
- Biliäre Sphinkterotomie
- Ballondilatation oder Bougierung
- PEG
- EUS-FNP
- Laserablation und -koagulation
- Behandlung von Varizen
- EMR**
- Transkutane FNP**
- Ligatur von Hämorrhoiden**
- Transkutane Leberbiopsie***

Aspirin oder NSAR oder in Kombination
- Niedrig-Risiko Eingriff
- Hoch-Risiko Eingriff
- Clopidogrel +/- Nicht-Aspirin-NSAR
- Aspirin + Clopidogrel

Aspirin/NSAR weiter*
Aspirin/NSAR weiter?/**
Nicht-Aspirin-NSAR/Clopidogrel weiter*
stop Clopidogrel erwägen***, wenn C. weiter*, NSAR stop
Aspirin + Clopidogrel weiter*
stop Clopidogrel erwägen***

3. Antikoagulation

Coumarine
- UFH
- LMWH
- +/- Aspirin
- +/- Clopidogrel

Coumarine, UFH, LMWH weiter*
stop Coumarin, UFH, LMWH, ev. Wechsel auf LMWH***
stop Coumarin, Wechsel auf LMWH oder Heparin**/***

* In Abwesenheit einer bekannten Blutungsneigung (hereditäre Koagulopathie, Niereninsuffizienz, Zirrhose, Tc<507000, Antikoagulation) kann der Eingriff durchgeführt werden
** In speziellen Hoch-Risiko-Situationen sollten Nicht-Aspirin-NSAR gestoppt und der Stop von Aspirin erwogen werden
*** Die Entscheidung, Aspirin und/oder Clopidogrel zu stoppen, sollte mit dem Zuweisender/Kardiologen/Angiologen/Neurologen besprochen werden
**** selektive Cox-2-Hemmer haben keinen Einfluss auf die Tc-Funktion

Post-ERCP complications – Acute cholangitis

Risk factors for post-ERCP cholangitis:

1. Combined percutaneous-endoscopic procedures (rendez-vous)
2. Stenting of malignant structures
3. Obstructive jaundice
4. Failed biliary access
5. Incomplete/failed biliary drainage
6. Low case volume endoscopy center
7. Male gender

How to avoid post-ERCP cholangitis?

1. Addition of antibiotics to contrast is useless
2. Placement of plastic stents (nasobiliary drain) in case of incomplete stone removal
3. Need for draining all intrahepatic segments that are filled with contrast in case of hilar tumours
ERCP-related complications – Perforations

1. Introducing/sstraightening of endoscope
2. ES-associated

Mechanisms of perforation during performance of a ES

Risk factors:

1. Billroth II anatomy
2. Precut vs. Sphincterotomy
3. Biliary stricture dilatation
4. Intramural injection
5. SOD
6. Dilated CBD
7. Duration of the procedure

I: guidewire, II: periampullary retroperitoneal, III: duodenal
Quality indicators for ERCP

Preprocedure
1. Apropriate indication >90%
2. Obtained informed consent >98%
3. Appropriate antibiotic therapy >98%
4. Performed by fully trained and credentialed endoscopist >98%
5. Performed by endoscopist with recorded volume of ERCPs >98%

Intraprocedure
1. Deep cannulation of the duct(s) of interest >98%
2. Deep cannulation of the duct(s) of interest with native papilla >90%
3. Extracted bile duct stones smaller than 1 cm >90%
4. Successful stent placement for biliary obstruction >90%
5. Measured and documented fluorescopy time and radiation dose >98%

Postprocedure
1. Reported specific techniques, particular accessories and all intended outcomes >98%
2. Report on acute adverse events >98%
3. Rate of post-ERCP pancreatitis NA (<5%)
4. Rate and type of perforation ≤0.2%
5. Clinically significant hemorrhage ≤1%
6. Patients contacted ≥14 days after procedure >90%