The Difficult ERCP: Tips to Succeed

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Indications for ERCP

- The jaundiced patient suspected of having biliary obstruction (appropriate therapeutic maneuvers should be performed during the procedure)
- The patient without jaundice whose clinical and biochemical or imaging data suggest pancreatic duct or biliary tract disease
- Evaluation of signs or symptoms suggesting pancreatic malignancy when results of direct imaging (e.g., ERCP, US, computed tomography [CT], magnetic resonance imaging [MRI]) are equivocal or normal
- Evaluation of pancreatitis of unknown etiology
- Preoperative evaluation of the patient with chronic pancreatitis and/or pseudocyst
- Evaluation of the sphincter of Oddi by manometry
- Empirical biliary sphincterotomy without sphincter of Oddi manometry is not recommended in patients with suspected type III sphincter of Oddi dysfunction

Endoscopic sphincterotomy:
- Choledocholithiasis
- Papillary stenosis or sphincter of Oddi dysfunction
- To facilitate placement of biliary stents or dilation of biliary strictures
- Sump syndrome
- Choledochotomy involving the major papilla
- Ampullary carcinoma in patients who are not candidates for surgery
- Facilitate access to the pancreatic duct
- Stone placement across benign or malignant strictures, fistulae, postoperative bile leak, or in high-risk patients with large unremovable common duct stones
- Dilatation of ductal strictures
- Balloon dilatation of the papilla
- Nasobiliary drain placement
- Pancreatic pseudocyst drainage in appropriate case
- Tissue sampling from pancreatic or bile ducts
- Ampullectomy of adenomatous neoplasms of the major papilla
- Therapy of disorders of the biliary and pancreatic ducts
- Facilitation of cholangiography and/or panendoscopy

Adler DG et al. ASGE/ACG Taskforce on Quality in Endoscopy. Am J Gastroenterol 2015;110
ACG/ASGE ERCP degrees of difficulty (2006)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Diagnostic</th>
<th>Therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: standard</td>
<td>Selective deep cannulation, diagnostic sampling</td>
<td>Biliary sphincterotomy, stones &lt;10 mm, stents for leaks and low tumors</td>
</tr>
<tr>
<td>2: advanced</td>
<td>Billroth II diagnostics, minor papilla cannulation</td>
<td>Stones &gt; 10 mm, hilar tumor stent placement, benign biliary strictures</td>
</tr>
<tr>
<td>3: tertiary</td>
<td>Manometry, Whipple, Roux-en-Y, intraductal endoscopy</td>
<td>Billroth II therapeutics, intrahepatic stones, pancreatic therapies</td>
</tr>
</tbody>
</table>

Baron TH et al. ASGE/ACG Taskforce on Quality in Endoscopy. Am J Gastroenterol 2006;101

ERCP complexity levels (2011)

**Basic ERCP**
1. Deep cannulation of duct of interest, main papilla, sampling
2. Biliary stone extraction <10 mm
3. Treat biliary leaks
4. Treat extrahepatic benign and malignant strictures
5. Place prophylactic pancreatic stents

**Advanced ERCP**
3. Biliary stone extraction >10 mm
   - Minor papilla cannulation in divisum, and therapy
   - Remove of internally migrated biliary stents
   - Intraductal imaging, biopsy, FNA
   - Manage of acute or recurrent pancreatitis
   - Treat pancreatic strictures
   - Remove pancreatic stones mobile and <5 mm
   - Treat hilar tumors
   - Treat benign biliary strictures, hilum and above
   - Manage suspected sphincter of Oddi dysfunction (with or without manometry)

Cotton PB et al. Gastrointest Endosc 2011;73
ERCP complexity levels (2011)

Tertiary ERCP

- Increase by 1 level (to a maximum of 4) for any procedure
  - Done outside of normal working hours
  - On a child younger than 3 years
  - That had been unsuccessful before

Cotton PB et al. Gastrointest Endosc 2011;73

ERCP success rates for “competency”

- 80% to 90% success for ERCPs with a difficulty grade of 1 and 2
  - Less experienced might want to avoid ERCP cases with a difficulty grade ≥3
- Cannulation rates
  - 95% or higher consistently achieved by experienced endoscopists
  - 80% or higher is goal of ERCP training programs
  - 85% success should be achievable for most endoscopists performing ERCP
- Use of precut methods in only 10% to 15% of cases
  - should not be used as an alternative to proper cannulation techniques
- 85% technical success for commonly performed procedures
  - stone extraction
  - relief of biliary obstruction
  - stent placement for bile leaks
- Successful placement of a biliary stent for relief of non-hilar biliary obstruction in 80% to 90% of patients

Baron TH et al. ASGE/ACG Taskforce on Quality in Endoscopy. Am J Gastroenterol 2006;101
ACG/ASGE proposed quality indicators for ERCP (2015)

<table>
<thead>
<tr>
<th>Quality indicator</th>
<th>Grade of recommendation</th>
<th>Measure type</th>
<th>Performance target (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Frequency with which deep cannulation of the ducts of interest is documented</td>
<td>1C</td>
<td>Process</td>
<td>&gt;90</td>
</tr>
<tr>
<td>2. Frequency with which deep cannulation of the ducts of interest is documented</td>
<td>1C</td>
<td>Process</td>
<td>&gt;90</td>
</tr>
<tr>
<td>3. Frequency with which common bile duct stones are removed in patients with normal bile duct anatomy are extracted successfully and documented (priority indicator)</td>
<td>1C</td>
<td>Outcome</td>
<td>≥90</td>
</tr>
<tr>
<td>4. Frequency with which stent placement for biliary obstruction in patients with normal anatomy whose obstruction is below the bifurcation is successfully achieved and documented (priority indicator)</td>
<td>1C</td>
<td>Outcome</td>
<td>≥90</td>
</tr>
</tbody>
</table>

Adler DG et al. ASGE/ACG Taskforce on Quality in Endoscopy. Am J Gastroenterol 2015;110

Case volume does not ensure competence

Wani S, Hall M, Wang AY et al. Gastrointest Endosc 2016;83
Expected adverse events from ERCP

- ERCP-induced pancreatitis: 1% to 7%
  - Situations and conditions in which this rate may be significantly higher
- Cholangitis: 1% or less
- Cholecystitis: 0.2% to 0.5%
- Hemorrhage (from sphincterotomy): 0.8% to 2%
- Perforations (guidewire, sphincterotomy, endoscope-related): 0.3% to 0.6%

Baron TH et al. ASGE/ACG Taskforce on Quality in Endoscopy. Am J Gastroenterol 2006;101

Risk factors for post-ERCP pancreatitis in multivariate analysis

<table>
<thead>
<tr>
<th>Yes</th>
<th>Maybe</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>CBD stone absent</td>
<td>Small CBD diameter</td>
</tr>
<tr>
<td>Younger age</td>
<td>Normal serum bilirubin</td>
<td>Periampullary diverticulum</td>
</tr>
<tr>
<td>Suspected SOD</td>
<td>Chronic pancreatitis absent</td>
<td>Pancreas divisum</td>
</tr>
<tr>
<td>Prior post-ERCP pancreatitis</td>
<td>Pancreatic brush cytology</td>
<td>Allergy to contrast media</td>
</tr>
<tr>
<td>Recurrent pancreatitis</td>
<td>Pain during ERCP</td>
<td>Prior failed ERCP</td>
</tr>
<tr>
<td>Pancreatic duct (PD) injection</td>
<td>Pancreatic acinarization</td>
<td>Therapeutic vs. diagnostic</td>
</tr>
<tr>
<td>Pancreatic sphincterotomy</td>
<td>Low-volume endoscopist</td>
<td>Intramural contrast injection</td>
</tr>
<tr>
<td>Difficult or failed cannulation</td>
<td>Trainee participation</td>
<td>Biliary sphincterotomy</td>
</tr>
<tr>
<td>Precut (access) sphincterotomy</td>
<td>Balloon dilation (of intact biliary sphincter)*</td>
<td>Sphinicter of Oddi manometry</td>
</tr>
<tr>
<td>Failed prophylactic PD stenting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Wang AY, Strand DS, Shami VS. Clin Gastroenterol Hepatol 2016; In Press
Pre-ERCP evaluation

- **Cross-sectional imaging** (CT, MRI/MRCP)
  - Evaluate anatomy
  - ? P divisum
  - Evidence of a mass or luminal stricture
  - Location of stricture
    - Extrahepatic, perihilar, intrahepatic
- **Cardiovascular risk**
- **Bleeding risk and medications**
- **Ability to provide informed consent**

Careful papillary inspection
Orientation of the BD and PD

Catheter cannulation of the bile duct
“Straightening the papilla”

The catheter is inserted at 11 o’clock, tangentially to the papilla to get an opacification.

The side wheel is turned left and the endoscope slightly pulled back to follow the anatomy.

The side wheel is turned back to the right and the catheter is pushed into the bile duct.

Deviere J. Endoscopy 2003;35
Devices

- **Sphincterotomes**
  - 4.9F, 4.4F, **3.9F**
  - 5F, **4F**
  - 4.5F, **4 F**
  - Rotatable, partially covered wire, single vs. multi-lumen, etc.

- **Cannulas**
  - Standard (0.035”), tapered (0.025”), ultra-tapered (0.018” wires)
  - Ball-tipped

- **Guide wires**
  - 0.035”, **0.025”**, 0.021”, 0.018”
  - Endoscopist-controlled wire system
  - Angle tipped
  - “Naked” hydrophilic Glidewire (0.035”)

Guidewire- vs. contrast-assisted biliary cannulation

- 12 RCTs (3,450 patients) were included in meta-analysis

- **GW-assisted cannulation technique**
  - **Reduced PEP**: RR 0.51, 95% CI: [0.32-0.82]
  - **Greater primary cannulation success**: RR 1.07, 95% CI: [1.00-1.15]
  - **Fewer precut sphincterotomies**: RR 0.75, 95% CI: [0.60-0.95]
  - No increase in other ERCP-related complications

Tse F et al. Endoscopy 2013;45
Thoughts during the difficult ERCP

• Is there a strong indication for this ERCP?
  – Cholangitis, bile leak, biliary decompression for chemo...
• Do I have the tools/training/assistants needed to complete the ERCP?
• Should I stop and come back another day?
  – Depends on indication
• Is there someone else experienced at ERCP available who can try?
• Should I stop and refer to a tertiary center?
• Do I have the proper consent for alternative methods?
  – EUS-guided intervention, PTC-rendezvous

If at first you don’t succeed...

• Repeat ERCP 4 days (median interval) after failed precut at the index ERCP was successful in 82% (73/89) of patients
• Complications after precut-sphincterotomy were observed in 17% (32/187) of patients
  
Pavlides et al. W J Gastroenterol 2014;20

• Repeat ERCP by the same endoscopist (median: 16 d) yielded an 87.5% success rate
  – Needle knife used in 21% cases
  – This led to an overall success rate of 95%
  
Ramirez FC et al. Gastrointest Endosc 1999;49
Advanced techniques for cases of difficult biliary cannulation

- If no P. divisum and the ventral PD is accessed
  - **Double guidewire (2-wire) technique**
  - **PD stent placement**
    - attempted biliary cannulation
    - if not successful, then precut needle-knife biliary papillotomy
  - **Transpancreatic sphincterotomy** (septotomy) for biliary access
    - EITHER double-GW biliary cannulation and then PD stenting
    - OR first placing a PD stent, then attempting biliary cannulation

- If the PD is not accessed/accessible or has P. divisum
  - **Freehand needle-knife precutting**
  - **Fistulotomy**
  - **EUS-guided rendezvous or other interventions**

Wang AY, Strand DS, Shami VS. Clin Gastroenterol Hepatol 2016; In Press

PD wire for biliary access

Wang AY, Strand DS, Shami VS. Clin Gastroenterol Hepatol 2016; In Press
PD stent to aid biliary access

Freehand needle-knife papillotomy for biliary access

Wang AY, Strand DS, Shami VS. Clin Gastroenterol Hepatol 2016; In Press
Challenging scenarios for ERCP

• Difficulty reaching the ampulla
  – Pyloric stenosis
  – Duodenal stricture

• Difficulty from ampullary anatomy
  – Periampullary diverticulum/variant ampullary anatomy
  – Ampullary mass
  – Ampullary sclerosis (scarred papilla)
  – Bile leak (decompressed distal bile duct)

• Difficulty from surgically altered anatomy
  – Billroth II
  – Roux-en-Y gastric bypass
  – Whipple
  – Also, sleeve gastrectomy, proximal esophagectomy/pullup, etc.

Adapted from Lee J. ACG Postgraduate Course 2012

Duodenal stricture dilation

Typically do not dilate beyond 13.5 mm to 15 mm
Scope follows a large dilating balloon

“Hooking method”

Kikuyama M, Itoi T, et al. Gastrointest Endosc 2009;70

Periampullary diverticula

Flynn MM...Wang AY. Gastrointest Endosc 2015;81
Clips to alter the papillary orientation

Needle knife precut over PD stent

50 y.o. M. with h/o sleeve gastrectomy who presented with gallstone pancreatitis, TB 3.2, and sludge and possible stone on EUS in the setting of a periampullary diverticulum.
Ampullectomy can enable access

Gaspar JP, Stelow EB, Wang AY. World J Gastroenterol 2016;22

Fistulotomy for ampullary carcinoma
Proximal esophagectomy and pullup  
(shifted pancreatico-biliary axis)

Billroth II gastrojejunostomy

Side-viewing duodoscope  
Forward-viewing endoscope

Canard JCL. Practical gastrointestinal endoscopy. Churchill 2011
Billroth II ERCP with duodenoscope

- 45 patients with a Billroth II gastrectomy
- Randomized to ERCP and endoscopic sphincterotomy (EST) with a forward-viewing endoscope or duodenoscope
- Successful cannulation of the papilla
  - 68% (15/22) with a duodenoscope
  - 87% (20/23) with a forward-viewing endoscope
- Successful EST
  - 80% (8/10) with a duodenoscope
  - 83% (10/12) with a forward-viewing endoscope

Kim MH et al. Endoscopy 1997;29:82-5

BII ERCP with a therapeutic gastroscope

ERCP in Billroth II
Roux-en-Y gastric bypass anatomy

SBE-ERCP for biliary stones in RYGB
Transgastric ERCP in RYGB anatomy

- Gastrostomy allows access into the remnant stomach
- A 32-26F Malecot tube allows the gastrostomy to stay open

Cosgrove ND, Wang AY. World J Surg Proced 2014;4

Stamm gastrostomy is not without risks

**Table 5. Complications of Stamm Gastrostomy**
*Duke Series of 88 Patients*

<table>
<thead>
<tr>
<th>#</th>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Wound infections</td>
</tr>
<tr>
<td>4</td>
<td>Exit site infections</td>
</tr>
<tr>
<td>1</td>
<td>Hemorrhage at gastrostomy site</td>
</tr>
<tr>
<td>4</td>
<td>Leakage at gastrostomy site</td>
</tr>
<tr>
<td>1</td>
<td>Tube withdrawal from stomach</td>
</tr>
<tr>
<td>2</td>
<td>Pain at tube exit site</td>
</tr>
<tr>
<td>1</td>
<td>Pyloric obstruction by tube</td>
</tr>
<tr>
<td>1</td>
<td>Gastrocutaneous fistula after tube out</td>
</tr>
<tr>
<td><strong>21</strong></td>
<td></td>
</tr>
</tbody>
</table>

Overall 23.9% Major 10.2%

Grant JP. Annals of Surgery 1988;207
**Gastrostomy-assisted ERCP**

**Immediate laparoscopy-assisted ERCP**
- Successful laparoscopic gastrostomy: 90% (27/30)
- Therapeutic ERCP success: 100%
- Adverse events: 13% (4/30)
  - 1 wound infection, 1 free air 47 days later with removal of tube,
  - 1 intra-abdominal leak, 1 pancreatitis

Gutierrez JM et al. J Gastrointest Surg 2009;13

**Delayed transgastric ERCP**
- Median wait between Stamm gastrostomy and ERCP: 47 days
- Therapeutic ERCP success: 100%


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**All cases**

n=59

**SBE-ERCP**

n=35

- Reached ampulla or HJ/PJ orifice n=27 (77%)
- Therapeutic ERCP success n=18 (64%)*
- Complications n=3 (9%)

**TG-ERCP**

n=24

- Reached ampulla n=24 (100%)
- Therapeutic ERCP success n=23 (96%)
- Complications n=9 (38%)

* 7 SBE-ERCP patients did not require therapeutic ERCP (denominator was 28)

Flynn MM...Wang AY et al. Gastrointest Endosc 2013;77
## EUS-guided transgastric transhepatic antegrade therapy for BD stones in RYGB

Table 1  Endoscopic ultrasound (EUS)-guided antegrade treatment of biliary stones in patients with gastric bypass.

<table>
<thead>
<tr>
<th>Patient age, sex</th>
<th>EUS ductography success</th>
<th>Wire placement across ampulla success</th>
<th>Antegrade sphincteroplasty and stone removal success</th>
<th>Sphincteroplasty size, mm</th>
<th>Procedure time, minutes</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>57, F</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>10</td>
<td>78</td>
<td>No</td>
</tr>
<tr>
<td>58, F</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>12</td>
<td>70</td>
<td>No</td>
</tr>
<tr>
<td>69, F</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>15</td>
<td>76</td>
<td>No</td>
</tr>
<tr>
<td>61, F</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>12’</td>
<td>100’</td>
<td>No</td>
</tr>
<tr>
<td>70, F</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>12</td>
<td>66</td>
<td>No</td>
</tr>
<tr>
<td>59, F</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>8’</td>
<td>144’</td>
<td>Hematoma</td>
</tr>
</tbody>
</table>

Weilert F...Shah JN et al. Endoscopy 2011;43
Cosgrove ND, Wang AY. World J Surg Proced 2014;4

## 1,000 consecutive biliary ERCPs

- 1000 ERCPs
- Non native papilla: n=476
- Native papilla: n=524
  - Ampulla reached: n=518 (98.9%)
  - Ampulla not reached: n=6 (1.1%)
    - Standard cannulation technique success: n=451
    - Advanced cannulation technique required: n=67 (12.9%)
  - Successful biliary cannulation: n=515 (98.3%)
  - Failed biliary cannulation: n=9 (1.7%)
    - EUS-guided drainage: n=3
    - PTC: n=4
      - No endoscopy: n=2

Holt BA...Varadarajulu S et al. Gastrointest Endoscopy 2016;83
Approach to EUS-BD interventions for malignancy

Also for benign disease

Failed malignant ERCP
Accessible papilla
Distal stricture
Rendezvous technique
Hilar stricture
Inaccessible papilla
Extrahepatic, Transhepatic
Choledocho-duodenostomy, hepaticogastrostomy or antegrade stenting

**Figure 1.** EUS-guided biliary drainage algorithm after failed ERCP for malignant obstruction.

Holt BA...Varadarajulu S et al. Gastrointest Endoscopy 2016;83

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EUS-guided rendezvous vs. precut for biliary access

**Table 2.** Success and complications

<table>
<thead>
<tr>
<th></th>
<th>Precut n = 144</th>
<th>EUS n = 58</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>First session success</td>
<td>130 (90.3%)</td>
<td>57 (98.3%)</td>
<td>.08</td>
</tr>
<tr>
<td>Overall success</td>
<td>138 (95.8%)</td>
<td>57 (98.3%)</td>
<td>.35</td>
</tr>
<tr>
<td>Overall complications</td>
<td>10 (6.9%)</td>
<td>2 (3.4%)</td>
<td>.22</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>4 (2.8%)</td>
<td>0</td>
<td>.25</td>
</tr>
<tr>
<td>Bleeding</td>
<td>6 (4.2%)</td>
<td>0</td>
<td>.12</td>
</tr>
<tr>
<td>Peri-choledochal contrast medium leak</td>
<td>— (—)</td>
<td>2 (3.4%)</td>
<td>—</td>
</tr>
</tbody>
</table>

Dhir V et al. Gastrointest Endosc 2012;75
Choledochoduodenostomy
(transduodenal transbiliary access)

Transgastric transhepatic antegrade transpapillary stenting

- 48 y.o. F with jaundice, nausea, and vomiting
- Labs: TB 15.1, ALT 304, AST 57, Alk phos 200

Teoh AY, Chong CC, Lau JY. Am J Gastroenterol 2015;110
MRCP and EUS of left liver

Transgastric transhepatic access and cholangiogram
EUS-guided biliary drainage after failed ERCP

<table>
<thead>
<tr>
<th></th>
<th>Intrahepatic (n=36)</th>
<th>Extrahepatic (n=56)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), years</td>
<td>61.8 (16.2)</td>
<td>68.9 (13.6)</td>
<td>0.03</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>16 (44.4)</td>
<td>25 (44.6)</td>
<td>0.99</td>
</tr>
<tr>
<td>Maximal (SD) bile duct diameter, mm</td>
<td>7.8 (3.7)</td>
<td>7.3 (3.1)</td>
<td>0.61</td>
</tr>
<tr>
<td>Mean (SD), pre-EUS-BD bilirubin, mg/dL</td>
<td>13.1 (7.5)</td>
<td>14.5 (9.6)</td>
<td>0.48</td>
</tr>
<tr>
<td>Mean (SD), post-EUS-BD bilirubin 4 weeks, mg/dL</td>
<td>1.4 (0.9)</td>
<td>2.1 (1.8)</td>
<td>0.07</td>
</tr>
<tr>
<td>Reduction in bilirubin, %</td>
<td>89.3</td>
<td>85.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Electrocautery, n (%)</td>
<td>19 (52.7)</td>
<td>24 (42.8)</td>
<td>0.40</td>
</tr>
<tr>
<td>Clinical success, n (%)</td>
<td>34 (94.4)</td>
<td>54 (96.4)</td>
<td>0.642</td>
</tr>
<tr>
<td>Procedure time, mean (SD), min</td>
<td>54.3 (34.9)</td>
<td>31.6 (18.1)</td>
<td>0.001 *</td>
</tr>
<tr>
<td>Length of hospital stay, mean (SD), days</td>
<td>6.6 (6.3)</td>
<td>3.2 (4.9)</td>
<td>0.01 *</td>
</tr>
<tr>
<td>Adverse event, n (%)</td>
<td>5 (13.8)</td>
<td>4 (7.1)</td>
<td>0.30</td>
</tr>
</tbody>
</table>

*Khashab M et al. Endoscopy International Open 2016;04
EUS-guided biliary drainage adverse events

<table>
<thead>
<tr>
<th>Complication</th>
<th>EUS severity grading</th>
<th>Age, years</th>
<th>Procedure type</th>
<th>Approach</th>
<th>Type of stent</th>
<th>Altered anatomy</th>
<th>Procedure duration, min</th>
<th>Hospital stay, days</th>
<th>Technical success</th>
<th>Clinical success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumoperitoneum (n=2)</td>
<td>Moderate</td>
<td>66</td>
<td>EUS</td>
<td>JPS</td>
<td>No</td>
<td>71</td>
<td>13</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mild</td>
<td>76</td>
<td>EUS</td>
<td>JPS</td>
<td>No</td>
<td>31</td>
<td>9</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Hemorrhage (n=1)</td>
<td>Mild</td>
<td>58</td>
<td>EUS</td>
<td>JPS</td>
<td>No</td>
<td>80</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
<tr>
<td>Bleeding (n=1)</td>
<td>Mild</td>
<td>56</td>
<td>EUS</td>
<td>JPS</td>
<td>No</td>
<td>42</td>
<td>4</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Pneumothorax (n=1)</td>
<td>Moderate</td>
<td>51</td>
<td>EUS</td>
<td>JPS</td>
<td>No</td>
<td>66</td>
<td>9</td>
<td>No</td>
<td>NA</td>
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<tr>
<td>Cholangitis (n=2)</td>
<td>Moderate</td>
<td>44</td>
<td>EUS</td>
<td>JPS</td>
<td>No</td>
<td>128</td>
<td>4</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Perforation (n=13)</td>
<td>Severe</td>
<td>60</td>
<td>EUS</td>
<td>JPS</td>
<td>No</td>
<td>75</td>
<td>1</td>
<td>Yes</td>
<td>NA</td>
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</tr>
</tbody>
</table>

Out of 96 total EUS-BD procedures

Khashab M et al. Endoscopy International Open 2016;04

Failed EUS-rendezvous with subsequent PTBD and “rendezvous”
Risks of PTBD/PTC

- **Success rate**
  - Opacification of dilated ducts: 95%
  - Opacification of non-dilated ducts: 65%

- **Success rate after opacification by PTC**
  - Cannulation of dilated ducts: 95%
  - Cannulation of non-dilated ducts: 70%

<table>
<thead>
<tr>
<th>Major Complication</th>
<th>Reported Rate (%)</th>
<th>Suggested Specific Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>2.5</td>
<td>5</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>2.5</td>
<td>5</td>
</tr>
<tr>
<td>Inflammatory/Infectious (abscess, peritonitis, cholecystitis, pancreatitis)</td>
<td>1.2</td>
<td>5</td>
</tr>
<tr>
<td>Pleural</td>
<td>0.5</td>
<td>2</td>
</tr>
<tr>
<td>Death</td>
<td>1.7</td>
<td>1</td>
</tr>
</tbody>
</table>

Percutaneous Transhepatic Biliary Drainage: Major Complications (10,28-30,32-33,64-66)

Saad WE et al. J Vasc Interv Radiol 2010;21

Thoughts during the difficult ERCP

- **Is there a strong indication for this ERCP?**
  - Cholangitis, bile leak, biliary decompression for chemo...

- Do I have the tools/training/assistants needed to complete the ERCP?

- **Should I stop and come back another day?**
  - Depends on indication

- **Is there someone else** experienced at ERCP available who can try?

- **Should I stop and refer to a tertiary center?**

- Do I have the proper consent for alternative methods?
  - EUS-guided intervention, PTC-rendezvous
“ERCP is most dangerous for those who need it least.”

Cotton PB. Gastrointest Endosc. 2001;54