ERCP: Pancreatobiliary tree without the surgeon

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Advocate Christ Medical Center
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Little Company of Mary Hospital
Advocate Good Samaritan Hospital

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• No political affiliations

ERCP and Advanced Endoscopy: Team Effort

• Strong team required for successful program:
  • Endoscopist, and well trained:
    – Nurses
    – Technicians
    – Cytopathologist
ERCP
Endoscopic Retrograde Cholangio Pancreatography

Bile is secreted by the liver and stored in the gallbladder

Liver
Gallbladder
Common bile duct
Major duodenal papilla
Estimated Procedural Volume - 2004

- United States - 445,000 cases per year
- Worldwide - 1.3-1.5 million cases per year

Sources: Timely Data Resources
PSPSF – Medicare claims Solutions
ERCP’s – United States 2004

- Diagnostic ERCP’s - 69,000
  - Decreasing ~ 4% per year
- Therapeutic ERCP’s - 376,000
  - Increasing ~ 12% per year

ERCP

- Historical contraindications
  - Pancreatitis
  - Cholangitis

ERCP-Current Indications

- Biliary Tract:
  - Choledocholithiasis
  - Benign obstruction
  - Malignant obstruction
  - Complications of laparoscopic cholecystectomy
ERCP-Current Indications

- Pancreatic disease
  - Acute pancreatitis with complications
  - Evaluation and management of recurrent pancreatitis
  - Chronic pancreatitis with complications

- Evaluation of imaging abnormalities - e.g. MRCP, CT, EUS
- Evaluation of abdominal pain ? SOD
- Excision of ampullary tumors

Case from Seattle

- 68 y/o MSM with h/o CAD, HTN, Diabetes, CRI presents with ~ 6 month upper abdominal pain, deep seated, vague, 3-5/10. Two attacks of mild pancreatitis.
- MRI scan: 3 cm mass ampullary region, 1.4 cm area of signal abnormality in HOP. Normal CBD and PD.
Case

- P/Hx:
  - CAD: CABG in '96
  - IDDM
  - HTN
  - CRI, creatinine around 2.2
  - Obesity

Physical Exam

- VSS
- Obese, ht 5.6", wt 235 lbs
- Otherwise unremarkable

Laboratory

- Hct 30
- Cr 2.2
- LFT’s Normal
- CA 19-9 Normal
- EUS: ampullary mass, no deep invasion
- Biopsies: Carcinoid
Ampullary Neoplasms

Familial Polyposis
- Disease prevalence: 1/5000 to 1/7500
- 50% to 80% will have adenomatous change of the papilla
- 4% to 12% lifetime incidence of duodenal cancer

Sporadic
- Prevalence: 0.04% to 0.12% in autopsy series
- Patients are usually > 40 years old (usually in 70s)

Presentation
- No symptoms
- Obstructive jaundice
  - 50% to 75% of symptomatic patients
  - Usually either painless or with a dull midepigastric ache
  - Up to 25% will have associated CBD stones due to cholestasis
- Abdominal pain
- Pancreatitis
- Bleeding and/or anemia
Staging

- Accurate staging is important to determine the appropriate intervention
- Methods:
  - U/S
  - CT
  - ERCP
  - EUS
  - IDUS

Treatment Options

- Endoscopic ampullectomy
- Surgery
  - Wide local excision
  - Pylorus-preserving resection of pancreatic head
  - Whipple
**Surgical management**

- Carcinoma
- Extension into CBD/PD
- Indeterminate staging
- Large >2 cm ??
- HGD: young, good health

**Complications of Endoscopic Ampullectomy**

- Pancreatitis: 8 to 15% (typically mild)
- Bleeding: 4 to 6%
- Perforation: 4%
- Stenosis:

**Endoscopic surveillance**

- Tubular histology
  - 2 to 3 years
- Unfavorable histology: Villous, HGD
  - 1 year
Critical Influences on ERCP

- Technology
  - Accessory development - e.g. guidewires, multilumen catheters, dilating balloons
  - “smart” cautery – e.g. ERBE
  - Smaller therapeutic scopes
  - Stent technology - plastic, SEMS

Critical Influences on ERCP

- Technology
  - Laparoscopic surgery
  - EUS
  - MRCP
  - High resolution CT

Case

- 55 y/o woman presents with 3 day h/o worsening abdominal pain and abdominal distention. Lap Chole 4 days ago.
- LFT’s mildly elevated
- Diagnosis:
- Next step???
Case

• 55 y/o woman presents with 3 day h/o worsening abdominal pain and abdominal distention.
• LFT’s mildly elevated
• Diagnosis:
• CT: fluid in GB fossa and around the liver

Case: 2

Critical Influences on ERCP

♦ Complications
  – Adverse outcomes-e.g. bleeding, perforation, pancreatitis
  – Cost/Resource utilization
  – Looming clouds of litigation
Tissue Acquisition

- Future directions/technologies
  - Expanded use of EUS/FNA
  - SPYGLASS biopsies
  - Pilot Balloon Cholangioscopy
  - IDUS probes
  - Tissue analysis-e.g. flow cytometry, molecular genetics, genotyping, FISH

Case

A 24 y/o woman presents with c/o severe 10/10 RUQ abdominal pain. She has 1 year hx of similar attacks of pain lasting few hours. Lap chole 14 months ago. Has seen her PCP on several occasions with same complaint, a KUB, CT scan and routine labs have been normal. On percocet for pain. Examination is unremarkable except slight voluntary guarding in RUQ.

Case

- Bouts of severe RUQ pain
- Labs normal
- CT normal
Case

- Bouts of severe RUQ pain
- Labs normal
- CT normal
- Treated as IBS
- ERCP: Slightly generous bile duct, manometry: high basal pressure 70 mmHg
- Sphincterotomy provided pain relief

18 months later, doing well
**Biliary Dyskinesia or Sphincter of Oddi Dysfunction**

- Approx 750,000 lap cholecystectomies performed every year
- 15 to 30% have recurrent or persistent pain
- Majority have biliary dyskinesia (or sphincter of oddi dysfunction)

**Sphincter of Oddi Dysfunction**

Two groups

- **Biliary group**: RUQ pain/epigastric, 1-2 hrs after food, abn LFTs, dilated ducts
- **Pancreatic group**: epigastric pain, radiating to back, alleviation on stooping, raised amylase levels

**Sphincter of Oddi Dysfunction**

* Biliary group classification:
  - **Type 1**: biliary-type pain
    - abn LFT >2N on at least 2 occasions
    - CBD dilated >12mm
    - delayed drainage of CBD >45min
  - **Type 2**: biliary-type pain and one or two of above criteria
  - **Type 3**: biliary-type pain only
# Sphincter of Oddi Dysfunction

## Pancreatic group classification:

<table>
<thead>
<tr>
<th>Type</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>unexplained acute recurrent pancreatitis, amylase $&gt;2N \times 2$, smooth dil of PD with no side-branch clubbing, delayed drainage of contrast $&gt;9$ min</td>
</tr>
<tr>
<td>Type 2</td>
<td>unexplained acute recurrent pancreatitis, amylase $&gt;2N \times 2$, normal PD and drainage</td>
</tr>
<tr>
<td>Type 3</td>
<td>pancreatic type pain only</td>
</tr>
</tbody>
</table>

## Type “IV” SOD

- Chronic un-remitting pain
- Depressed
- Symptoms of Gastroparesis
- All potentially causative organs excised

## Type “IV” SOD

- Failed all prior therapies
- Taking anti-depressants
- Taking long acting Narcotics
Type “IV” SOD

• Normal physical exam
• Normal lab values
• Normal imaging studies
• Difficult to manage!!

Sphincter of Oddi Dysfunction (SOD)

The typical patient with SOD
• female, 20-50 years old
• s/p cholecystectomy
• symptoms similar to pre-cholecystectomy
• episodic (or constant) pain

Sphincter of Oddi Dysfunction

Clinical evaluation:
• History and Physical
• CXR, EKG
• Abdo U/S, LFTs, Amylase/Lipase
• EGD
• CAT scan
• Secretin EUS or Secretin MRCP.
• HIDA
• ERCP with Manometry
Sphincter of Oddi Manometry (SOM)

Requirements for successful SOM
• skillful endoscopist and nurses
Sphincter of Oddi Manometry

**Abnormal values**
- Basal sphincter pressure > 40mmHg
- Phasic contractions
  - amplitude >220mmHg
  - duration > 8 sec
  - frequency > 10/min
  - retrograde > 50%

Increased basal sphincter pressure is the most reproducible and predictive of positive therapeutic outcomes

**Results of ES**

<table>
<thead>
<tr>
<th>Basal SOP mmHg</th>
<th>Group</th>
<th>Pain relief at 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30mmHg</td>
<td>ES(11)</td>
<td>91%</td>
</tr>
<tr>
<td></td>
<td>sham(12)</td>
<td>24%</td>
</tr>
<tr>
<td>&lt;30mmHg</td>
<td>ES(12)</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td>sham(12)</td>
<td>33%</td>
</tr>
</tbody>
</table>

Geenen et al. Gastro 1987;92:1401
**Predictors of post-ERCP Pancreatitis by Multivariate Analysis**


<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Female + Normal Bilirubin</th>
<th>Female + Normal Bilirubin + SOD</th>
<th>Female + Normal Bilirubin + Difficult Cannulation</th>
<th>Female + Normal Bilirubin + SOD + Difficult Cannulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatitis (%)</td>
<td>2.5</td>
<td>4.8</td>
<td>12.4</td>
<td>16.2</td>
<td>42.1</td>
</tr>
</tbody>
</table>

**Pancreatic Stents in SOD**


- 80 patients with pancreatic sphincter hypertension, biliary ES for SOD
- Randomized to short-term PD stent or no stent after biliary ES

**Sphincter of Oddi Dysfunction: Conclusions**

- SOD is a common cause of upper abdominal pain after lap chole
- ERCP with manometry is the gold standard for diagnosis
- Endoscopic sphincterotomy is the treatment of choice
- Medical therapy of limited value
Sphincter of Oddi Dysfunction: Conclusions

- SOD manometry is technically difficult and hazardous procedure
- Success rate still 50 to 85%
- Properly trained and skilled endoscopist and nurses required

ERCP: Complications

- Pancreatitis
- Bleeding
- Perforation
- Infection

Can ≠ Should

Richard Kozarek, M.D.
Major Complications of ERCP
(Consensus Definitions)

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pancreatitis</strong></td>
<td>Amylase at least 3 times normal at more than 24 hours after procedure, requiring admission for 2-5 days</td>
<td>Pancreatitis requiring hospitalization of 4-10 days</td>
<td>Hospitalization for more than 10 days, pseudocyst, or intervention</td>
</tr>
<tr>
<td><strong>Hemorrhage</strong></td>
<td>Clinical evidence of bleeding, hemoglobin drop &lt;5 g, no transfusion</td>
<td>Transfusion (4 units or less), no angiographic intervention or surgery</td>
<td>Transfusion 4 units or more, or intervention (angiographic or surgical)</td>
</tr>
<tr>
<td><strong>Perforation</strong></td>
<td>Possible, or only very slight leak of fluid or contrast</td>
<td>Any definite perforation treated medically 4-10 days</td>
<td>Medical treatment for more than 10 d, or intervention (percutaneous or surgical)</td>
</tr>
<tr>
<td><strong>Infection</strong></td>
<td>&gt;38°C for 24-48 hours</td>
<td>Febrile or septic illness requiring &gt;3 days of hospital treatment or a percutaneous intervention</td>
<td>Sepsic shock or surgery</td>
</tr>
</tbody>
</table>

Risk Factors for Complications of ERCP
(in Multivariate Analyses)

<table>
<thead>
<tr>
<th></th>
<th>Definitive</th>
<th>Maybe</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected sphincter of Oddi dysfunction</td>
<td>Young age</td>
<td>Comorbid illness burden</td>
<td></td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>Pancreatic contrast injection</td>
<td>Small common bile duct diameter</td>
<td></td>
</tr>
<tr>
<td>Difficult cannulation</td>
<td>Failed biliary drainage</td>
<td>Female gender?</td>
<td></td>
</tr>
<tr>
<td>Percutaneous biliary access</td>
<td>Bilroth II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower ERCP case volume</td>
<td>Periampullary diverticulum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Freeman ML. Adverse outcomes of ERCP. Gastrointestinal Endoscopy, December 2002-Part 2-Volume 56-Number 6

Pancreatitis

Risk Factors
Risk-Reduction Strategies
Risk Factors for Post-ERCP Pancreatitis

<table>
<thead>
<tr>
<th>Definite</th>
<th>Maybe</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected sphincter of Oddi dysfunction</td>
<td>Female Gender</td>
<td>Small Common Bile Duct diameter</td>
</tr>
<tr>
<td>Young Age</td>
<td>Acinarization</td>
<td>Sphincter of Oddi manometry</td>
</tr>
<tr>
<td>Normal bilirubin</td>
<td>Absence of common bile duct stone</td>
<td>Biliary Sphincterotomy</td>
</tr>
<tr>
<td>History of post-ERCP pancreatitis</td>
<td>Lower ERCP case volume</td>
<td></td>
</tr>
<tr>
<td>Pancreatic duct injection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreatic sphincterotomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-cut sphincterotomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balloon dilation of biliary sphincter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Risk Factors for Procedure-Induced Pancreatitis

Several factors may act independently or in combination to induce post-ERCP pancreatitis:

- Mechanical Injury
- Chemical or Allergic Injury
- Hydrostatic Injury
- Infection
- Enzymatic Injury
- Pancreatic Ductal Edema or Perforation
- Thermal Injury


Pancreatitis Risk-Reduction Strategies

Strategies are broken out into two groups*:

1. Patient Selection
2. Procedural Technique

*Listed in no particular order
Patient Selection
Risk Reduction Strategy

Special caution should be exercised when considering a patient with a demonstrated “reactive” pancreas when considering or performing ERCP. These patients include:

- Younger patients
- Female gender
- Recurrent abdominal pain in the absence of proven anatomic biliary obstruction
- History of recurrent or post-ERCP pancreatitis
- Patients with multiple risk factors

ERCP is most dangerous for people who need it least.

-Peter Cotton, M.D. Gastrointestinal Endoscopy 2001;54(4) 535-536.

Procedural Technique
(Pancreatic Stent)

<table>
<thead>
<tr>
<th>Setting</th>
<th>Benefit</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biliary Sphincterotomy for SOD</td>
<td>Yes</td>
<td>RCT</td>
</tr>
<tr>
<td>Pancreatic sphincterotomy for SOD</td>
<td>Yes</td>
<td>RCT (abstract)</td>
</tr>
<tr>
<td>Biliary balloon dilation for stone</td>
<td>Yes</td>
<td>RCT</td>
</tr>
<tr>
<td>Pre-cut biliary sphincterotomy</td>
<td>Yes</td>
<td>RCT (abstract)</td>
</tr>
<tr>
<td>High risk, including difficult cannulation</td>
<td>Equivocal</td>
<td>RCT</td>
</tr>
</tbody>
</table>

SOD, sphincter of Oddi dysfunction

RCT, Random Controlled Trial
Procedural Technique (Pancreatic Stent)

- Before pre-cut (access) papillotomy
- Before or after biliary sphincterotomy for SOD
- Pancreatic sphincterotomy
- Endoscopic papillotomy
- After manometry or pancreatic instrumentation for suspected SOD
- Balloon dilation of the intact biliary sphincter
- Pancreatic brush cytology
- After a difficult cannulation
- Repeated pancreatic duct injections of contrast in patients with other risk factors.


Procedural Technique (Guidewire Cannulation)

A recent study tested the hypothesis that post ERCP pancreatitis can be avoided by initially accessing the bile duct with a soft-tipped Teflon® coated tracer 0.035-inch guidewire.

- 2 year study
- 400 Patients (182 M / 218 F)
- Mean age: 61.2 years (Range: 22-94)
- Participants broken into 2 groups:
  - Group A – Guidewire Cannulation Used to Access Duct
  - Group B – Traditional Access Method Used
- No case of acute pancreatitis was detected in group A, whereas, 8 cases were observed in group B (6 mild, 1 moderate, 1 severe)

* Teflon is a trademark of E.I. DuPont de Nemours and Company


Post-ERCP Pancreatitis


![Post-ERCP Pancreatitis Chart]

Diagnostic n=353 Therapeutic n=1513
Pancreatic Stents in SOD


- 80 patients with pancreatic sphincter hypertrophy, biliary ES for SOD
- Randomized to short-term PD stent or no stent after biliary ES

Post-ERCP Pancreatitis: Insights from clinical Studies

- Patient-related factors are major determinants of risk
- Cannulation difficulty is important, but less than generally thought
- Pancreatic stents reduce risk in selected circumstances


Pancreatic Stents in SOD

Post-ERCP Pancreatitis Rates


<table>
<thead>
<tr>
<th>Stent</th>
<th>N</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3F</td>
<td>1451</td>
<td>85 (6%)</td>
<td>18 (1.3%)</td>
<td>4 (0.2%)</td>
<td>107 (7.5%)</td>
</tr>
<tr>
<td>4F</td>
<td>996</td>
<td>80 (8%)</td>
<td>20 (2%)</td>
<td>6 (0.6%)</td>
<td>106 (10.6%)</td>
</tr>
<tr>
<td>5F</td>
<td>377</td>
<td>28 (7.4%)</td>
<td>6 (1.6%)</td>
<td>3 (0.8%)</td>
<td>37 (9.8%)</td>
</tr>
<tr>
<td>6F</td>
<td>116</td>
<td>14 (12%)</td>
<td>2 (1.8%)</td>
<td>1 (0.0%)</td>
<td>17 (14.6%)</td>
</tr>
</tbody>
</table>
Spontaneous Pancreatic Polyethylene Stents Dislodgment


![Bar chart showing spontaneous dislodgment rate by stent diameter.]

Polyethylene Stent-Induced Pancreatic Ductal Changes


![Bar chart showing frequency of stent-induced ductal changes by stent diameter.]

Post ERCP pancreatitis: Indomethacin suppository
Summary: Risk Reduction for Post-ERCP Pancreatitis

- Careful patient selections
- Meticulous endoscopic technique
- Insertion of a pancreatic stent in selected patients
- Endoscopist who maintains ERCP procedural volume
- Well trained (high volume) nurses/techs


Hemorrhage

Risk Factors
Risk Reduction Strategies
Hemorrhage

- Bleeding may occur primarily after sphincterotomy
- Presentation may be delayed up to 10 days after sphincterotomy
- Bleeding can usually be managed by endoscopic therapy, with surgery very seldom required.

Freeman ML. Toward improving outcomes of ERCP. Gastrointestinal Endoscopy, July 1998- Volume 48-Number 1

Freeman ML. Adverse outcomes of ERCP. Gastrointestinal Endoscopy, December 2002-Part 2-Volume 56-Number 6

Risk Factors for Hemorrhage after Endoscopic Sphincterotomy

<table>
<thead>
<tr>
<th>Factor</th>
<th>Definite</th>
<th>Maybe</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulopathy</td>
<td></td>
<td></td>
<td>ASA or NSAID use</td>
</tr>
<tr>
<td>Anticoagulation &lt;3 d after ES</td>
<td></td>
<td>Cirrhosis</td>
<td></td>
</tr>
<tr>
<td>Cholangitis before ERCP</td>
<td></td>
<td>Dilated common bile duct</td>
<td>Ampullary tumor</td>
</tr>
<tr>
<td>Bleeding during ES</td>
<td></td>
<td>Common bile duct stone</td>
<td>Longer sphincterotomy</td>
</tr>
<tr>
<td>Lower ERCP case volume</td>
<td></td>
<td>Periampullary diverticulum</td>
<td>Extension of prior ES</td>
</tr>
<tr>
<td>Pre-cut sphincterotomy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Freeman ML. Adverse outcomes of ERCP. Gastrointestinal Endoscopy, December 2002-Part 2-Volume 56-Number 6

Reducing the Risk of Hemorrhage

- Correction of any coagulopathies
- Withholding anticoagulant medications
- Prophylactic injection of the sphincterotomy site with epinephrine
- Prophylactic injection of the sphincterotomy site with a sclerosing agent
- Balloon tamponade
- Clipping of clearly defined vessel for hemostasis

Freeman ML. Adverse outcomes of endoscopic retrograde cholangiopancreatography: avoidance and management. Gastrointestinal Endoscopy clinics of North America – Volume 13 Issue 4, Pages 775-798 October 2003
Perforation
• Perforation is now reported in less than 1% of ERCPs and sphincterotomies.
• Perforation may be retroperitoneal because of extension of a sphincterotomy incision beyond the intramural portion of the bile or pancreatic duct.
• Perforation may be intraperitoneal as a result of perforation of the bowel wall by the endoscope, or occur at any location because of extramural passage or migration of guide wires or stents.

Risk Factors for Perforation
• Literature states that perforation after sphincterotomy is more common in patients with:
  - Suspected sphincter of Oddi dysfunction
  - Needle-knife pre-cut techniques
  - Billroth II anatomy

Reducing the Risk of Perforation
• Limit the length of cutting wire in contact with the tissue.
• Use of stepwise incisions.
• Reassessing the amount of remaining papillary mound during the incision.
• Using special caution with needle-knife papillotomy.
Infection (Cholangitis and Cholecystitis)

Risk Factors
Risk Reduction Strategies

Risk Factors for Cholangitis and Cholecystitis

- Failed or incomplete biliary drainage
- Use of combined percutaneous-endoscopic procedure
- Jaundice especially if caused by malignancy
- Prior cholangitis
- Operator inexperience

Freeman ML. Adverse outcomes of endoscopic retrograde cholangiopancreatography: avoidance and management. Gastrointestinal Endoscopy clinics of North America – Volume 13 Issue 4, Pages 775-798 October 2003
Reducing the Risk of Cholangitis and Cholecystitis

• The principle recommendation regarding prevention and treatment of cholangitis is obtaining successful and complete biliary drainage.

Summary

Complications of ERCP

• Major complications of ERCP are:
  – Pancreatitis, Hemorrhage, Perforation and Infection
• Risk factors related to ERCP are:
  – Pre-procedural (related to patient selection)
  – Technique-related; operator inexperience
• Complications may be reduced if risk-reduction strategies are understood and employed

Case

• A 46 y/o Asian lady from Juneau, with 5 week h/o severe attacks of abdominal pain and vomiting
• Pain severe, 10/10 during episode, vague constant discomfort in between episodes
• Examination reveal mild abdominal tenderness
• CT/USS scan unremarkable
• Treated by GI as SOD, with analgesics, nifedipine and reassurance
Case

• During a pain episode:
  – Amylase 1200, Lipase 2000,
  – Bili 2.2, Alk Phos 218
• GI spoke to me and sent the pt to Seattle
• Next step: EUS? ERCP? MRCP?

Case: SOD ?

Future Directions/Ideas

- Drug-eluting stents
- Functional miniprobes
- PDT
- New lasers
- Biodegradable stents
- Hybrid scopes-EGD, EUS, ERCP
- Secretin MRCP
- NOTES

NOTES
The sole purpose of human existence is to kindle a light in the darkness of mere being

C G Jung