Biliary Strictures: the Long and the Short of It

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Disclosure

• Consultant to Cook Medical
Objectives

1) Understand the causes of biliary strictures
   - A) Malignancy
   - B) Inflammation
   - C) Iatrogenic

2) Outline the diagnostic studies available to evaluate biliary strictures
   - A) Non-invasive: CT and MRI
   - B) ERCP and cholangioscopy
   - C) EUS

3) Define management options, including stenting and surgery
   - A) Dilation
   - B) Plastic and metal stenting
   - C) Bypass surgery vs resection
Definition of Stricture:

An abnormal narrowing of a bodily passage
Biliary Strictures
Normal Endoscopic Retrograde Cholangiogram
Right Side
(away from spine and usually on gallbladder side)
Intra-Hepatic Ducts
Extra-hepatic Ducts
Right Hepatic Duct......
Confluence....
Cystic Duct...
Gallbladder...

......Left Hepatic Duct

..................CHD

..Cystic Duct Origin

......CBD

...Biliary Sph.
Hilum of Liver

Porta Hepatis
Normal Pancreaticobiliary Anatomy

- Normal bile duct diameter $\leq 7$ mm

- Causes of Duct Dilation
  - Disease
  - Functional
    - Post-cholecystectomy (CCY)
    - Peri-ampullary diverticulae
    - Aging
Biliary Strictures – Rule #1

• Perform balloon occlusion cholangiogram to obtain high quality views of the intra-hepatic ducts
  • Whenever PSC or another disease associated with intra-hepatic duct strictures is suspected
Balloon Occlusion Cholangiogram to Obtain Better Views of IHD
How to Measure during ERCP

• Use the scope diameter as a measurement tool
  • Olympus TJF-180 has an 11.3mm outer diameter
  • In this example, the maximum bile duct diameter is approximately 50% greater than the scope diameter or ~17 mm (11.3mm + 5.65mm)
Length of the CBD Stricture?

- A) 1 cm
- B) 2 cm
- C) 4 cm
- D) 10 cm
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More Common Causes of Biliary Strictures

- Malignancy
  - Pancreas, bile duct, gallbladder, metastatic, lymphoma

- Inflammatory
  - PSC
  - Acute or chronic pancreatitis
  - IgG4-associated cholangitis

- Iatrogenic
  - Post-cholecystectomy
  - Post-liver transplant or bile duct surgery
Less Common Causes of Biliary Strictures

- Ischemic cholangiopathy
- Choledocholithiasis
- Eosinophilic cholangitis
- Intra-arterial chemotherapy
- Mast cell cholangiopathy
- Portal hypertensive biliopathy
- Recurrent pancreatitis
- Recurrent pyogenic cholangitis
Biliary Tract Obstruction from Malignancy

- Causes jaundice, pruritis, pain, occasionally cholangitis
- Stenting relieves obstructive symptoms and improves QOL
Distal CBD Stricture
Biliary Strictures – Rule #2

- It is better to obtain high quality non-invasive imaging *prior to* performing ERCP or EUS
  - Thin-cut helical CT with IV contrast
  - MRI abdomen with MRCP and IV contrast
- This allows for a better road map and planning of need for and type of invasive procedure
- The presence of a biliary stent impedes not only CT and MRI images but also EUS imaging
Normal MRCP

- Bile duct
- Pancreas duct
- Major Papilla/Ampulla of Vater
Triphasic Thin Cut Helical CT Scan
Cholangiocarcinoma = Bile Duct Cancer

- Risk factors: PSC, choledochocysts, parasites
- 5\textsuperscript{th}-7\textsuperscript{th} decades
- M>F
- Painless jaundice + weight loss
- Curative surgery uncommon
Biliary Strictures – Rule #3

• Obtaining a pancreatogram is often helpful in the assessment of a biliary stricture
  • The presence of an associated pancreatic stricture argues against cholangiocarcinoma or an iatrogenic etiology
  • The presence of a dominant PD stricture in head suggests pancreatic cancer, acute or chronic pancreatitis, pancreatic lymphoma
  • The presence of multiple pancreatic strictures or irregularities suggests IgG4-associated cholangitis
Pancreas Cancer

- 60-75% occur in head
- Few early symptoms
- Rx: Whipple for the 15% that appear resectable after staging; palliative stenting, chemoXRT, pain Rx for the remainder
CBD Stricture: Benign or Malignant?
ERCP Tissue Sampling

• Brushing is quickest/easiest
• ERCP with FNA or intra-ductal biopsies possible but technically challenging
Biliary Strictures – Rule #4

• All strictures of unclear etiology should be brushed for cytology
• Brushing should be aggressive
• Brushes should be cut and placed into Cytolyte quickly
  • Avoid air drying
  • Let the experts (cytotechnologists) prepare the sample
OTW Brush Cytology
ERCP - Intra-ductal Biopsies
What If the ERCP Tissue Sampling is Non-Diagnostic?

• If a mass is present on CT or MRI, proceed with EUS/FNA

Video of EUS/FNA of Head of Pancreas Mass
What If the ERCP Tissue Sampling is Non-Diagnostic?

• If a mass is not present, consider cholangioscopy
Peroral Cholangioscopy

Indications
- Platform for advanced lithotripsy
- Investigation of indeterminate strictures
- Exclusion of malignancy in PSC

Logistics & Results
- Acquisition & procedure cost
- Set-up time/procedure length
- Spy directed biopsies 63% sensitive, complete stone removal in 81-90%, patient management altered in 28%*

*Chathadi KV and Chen YK. from Gastrointest Endosc Clinics of N America 2009; 19:545-555
DS Spyglass (BSC)

Single-operator, disposable, steerable, POC catheter with 2 dedicated irrigation channels, 1 channel for optical probe, 1 working channel, and disposable SpyBite biopsy forceps.
Video of Normal Cholangioscopy with DS Spyglass
Video of Cholangioscopy of Cholangiocarcinoma Using DS Spyglass
Biliary Strictures – Rule #5

• Cholangioscopy should be strongly considered for strictures that may be malignant but have no associated mass on CT or MRI and/or with previous negative tissue sampling
Plastic Stent Nomenclature

• Stent diameter is measured in “French” – this is .33mm
  • A 10Fr stent is 3.3mm in diameter
• Stent length is measured in cm
• When describing a stent, the diameter is mentioned first, then the length, then any other special features
  • For example, “a 10Fr 7cm double pigtail stent”
## Plastic vs Metal Biliary Stenting for Malignancy

<table>
<thead>
<tr>
<th>Plastic</th>
<th>Metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inexpensive initially</td>
<td>Expensive initially</td>
</tr>
<tr>
<td>Shorter patency</td>
<td>Longer patency</td>
</tr>
<tr>
<td>Avg 12 wks (10 Fr)</td>
<td>Avg 24 wks</td>
</tr>
<tr>
<td>Removable</td>
<td>Permanent*</td>
</tr>
<tr>
<td>Less cost effective</td>
<td>More cost effective</td>
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</tbody>
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*Coated stents usually are removable
Biliary Strictures – Rule #6

• Do not place *uncoated* metal biliary stents across biliary strictures unless a cancer diagnosis exists
  • Uncoated stents are permanent and can be difficult for surgeon to remove
• If a patient with malignancy may have an attempt at surgical resection, it is important to place the uncoated metal biliary stent at least 2cm away from the confluence
Available Metal Biliary Stents*

- Alimaxx-B (Alveolus)
- Evolution (Cook)
- Flexxus (ConMed)
- Niti-S (Tae Woong Med)
- Viabil (ConMed)

- Wallflex (BSC)
  - Uncoated & Coated
- Wallstent (BSC)
  - Uncoated & Coated
- X-Suit (Olympus)
- Zilver (Cook)

*As of March 2017
Covered Metal Biliary Stents

**PROS**

- Usually removable
- May be the best option for benign or indeterminant biliary strictures

**CONS**

- Almost twice as expensive
- Multiple studies showing no benefit of coated stents,* including two multicenter RCTs**

*Park HD et al. *Clin Gastroenterol Hepatol* 2006; 4:790-796
*Yoon WJ et al. *GIE* 2006; 63:996-1000
*Cho YD et al. *GIE* 2009; 69:AB1114
**Telford et al. *GIE* 2010; 72:907-914
**Kullman et al. *GIE* 2010; 72:915-923
Video of Removal of Coated Metal Biliary Stent
Biliary Strictures – Rule #7

• Do **not** place *coated* metal biliary stents at or above the confluence
  • The coated nature of the stent will block multiple biliary radicles and can result in poor biliary drainage and/or cholangitis

• Coated metal biliary stents can be placed in “indeterminant strictures,” especially if the clinical and radiographic data suggest malignancy
Metal Biliary Stents*- Which Ones Shrink?

**Non-Foreshortening Stents**
- Alimaxx-B (Alveolus)
- Flexxus (ConMed)
- Niti-S (Tae Woong Med)
- Viabil (ConMed)
- X-Suit (Olympus)
- Zilver (Cook)

**Forshortening Stents**
- Evolution
- Wallflex (coated and uncoated)
- Wallstent (coated and uncoated)

*As of March 2017*
Video of ERCP – Distal Cholangiocarcinoma with Metal Biliary Stent Placement
Metal Stent Deployment - Tips for Techs and Nurses

- Double check which stent the doc wants to use prior to opening the package
- Know the guide wire location
- As you deploy the stent, say “deploying”
- If you encounter resistance, let the doc know and ask if the elevator is closed
Biliary Strictures – Rule #8

- During biliary stent deployment, communication between the doctor and the assistant is very important
Bismuth Classification of Hilar Obstruction

Fig. 1. Bismuth-Corlette classification of perihilar tumors [6]. Type I = Tumor below the confluence of the right and left hepatic bile ducts; type II = tumor involving the confluence; type IIIa = tumor involving the secondary branches of the right biliary system; type IIIb = tumor involving the secondary branches of the left biliary system, and type IV = secondary branches on both sides affected by tumor.
Video of ERCP of Complex Hilar Stricture
Management of Hilar Strictures

• CT- and MRCP-directed therapy
• No consensus re: plastic vs metal or unilateral vs bilateral
• Percutaneous biliary drains sometimes necessary instead of, or in addition to, endoscopic stents
• The GI team must collaborate with IR and Surgery consultants
UNILATERAL METAL BILIARY STENT
UNILATERAL METAL BILIARY STENT
UNILATERAL METAL BILIARY STENT
UNILATERAL METAL BILIARY STENT

“Waist” of Stent
Videos of Simultaneous Bilateral Metal Biliary Stent Placement Across Hilar Cholangiocarcinoma
Biliary Strictures – Rule #9

• If a hilar stricture is suspected, the patient should be referred to an expert/center of excellence
  • Hilar cholangiocarcinomas are notoriously difficult to diagnose, to stent, to treat, to cure
  • Several studies show shortened patient survival time when ERCP is done, ducts are filled but not drained
Primary Sclerosing Cholangitis
Chronic, progressive, fibrosing inflammatory disease of bile ducts

- 70% of PSC pts have IBD
- 15% will develop cholangiocarcinoma
- Dx: ERCP or MRCP
- Rx: Treat dominant strictures, liver transplant
PSC with a “Dominant Stricture”
Biliary Stricture from IgG4-Associated Cholangiopathy
Biliary Strictures – Rule #10

• Administer broad-spectrum antibiotics before and after invasive biliary procedures in the following patients:
  • PSC
  • Complex hilar or intra-hepatic strictures
  • Any percutaneous biliary procedures (e.g. PTC/PTB)
  • Any stricture where drainage isn’t good at end of ERCP
  • Immunocompromised patient including post-liver transplant and chemotherapy patients
  • Any patient undergoing cholangioscopy
Chronic Pancreatitis

- Fibrosis & atrophy of pancreas
- 70% alcohol related
- Abdominal pain, steatorrhea, weight loss, diabetes
- Rx: pain management, pancreatic enzymes, ERCP/pancreatic endotherapy, surgery
CBD Strictures from Chronic Pancreatitis

• Fibrosis within head of pancreas encases CBD
• Treatment prevents liver fibrosis
• Treatment options
  • Balloon dilation and progressive multiple plastic stents
  • “Removable” covered metal stents (off label use)*
  • Surgical hepaticojejunostomy

Cahen DI et al. Endoscopy 2008; 40:697-700
Benign CBD Stricture Due to Chronic Pancreatitis

Snape’s Syndrome

CBD Stricture

Pancreatic Calcification
Dilation of Pancreaticobiliary Strictures

**BOUGIE**

**BALLOON**
Dilation of Pancreaticobiliary Strictures

**BOUGIE**
- $$
- Easy prep
- Linear/shear force
- Less effective in proximal locations

**BALLOON**
- $$$
- Harder prep
- Radial force
- Effective in all locations

Screw dilation is reserved for strictures too tight to accommodate a bougie or balloon dilator
Balloon Dilation & Double Plastic Stenting of Benign CBD Stricture
CHD Stone Above Benign Biliary Stricture/Balloon Dilation of Stricture
Multiple Plastic Stents Across Benign CBD Stricture
Cholangiogram after Removal of Multiple Stents
Iatrogenic Biliary Strictures

• Usually a consequence of cholecystectomy, bile duct surgery, or liver transplant
• Majority can be successfully managed by ERCP/stenting
• Better results if stricture is discovered and treated early
Post-Cholecystectomy Stricture

Mid-Bile Duct Stricture with Leak
Proximal Balloon
Radiopaque Marker
Elimination of the Balloon “Waist”
Placement of Plastic Stent across Stricture
8.5 Fr Soehendra Stent Extractor (Cook) May be Used as a Screw Dilator

Faigel et al. GIE 1996; 44:635
Vida et al. GIE 1998; 47:109
Brand et al. Endoscopy 1999; 31:142
High Grade, Mid-Bile Duct Stricture
Screw Dilator in Stricture
Screw Dilator Through Stricture
Iatrogenic Bile Leak

Air Bubbles
10 Fr Plastic Biliary Stent
Post-Living Related Liver Transplant
Anastomotic Stricture
Summary

- Balloon occlusion cholangiogram helpful
- Do CT/MRI prior to ERCP/EUS
- Pancreatography helpful
- Brush all indeterminate strictures
- Consider cholangioscopy for indeterminate strictures
- Don’t place uncoated stents unless cancer diagnosis present
- Don’t place coated stents at/above confluence
- Communicate during stent deployment
- Refer hilar strictures to experts
- Give antibiotics for complex strictures, PTC, cholangioscopy, immunocompromised patients