Endoscopic Management of the Iatrogenic CBD Injury

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Management of the iatrogenic CBD Injury

- Surgery
  - The mainstay of therapy in the past
  - Possible morbidity and mortality

- Endoscopic therapy
  - Can be the first therapeutic option in selected patients
  - Primary effective nonoperative treatment

- Percutaneous intervention
  - Reserved for failed endoscopic procedures
Causes of the iatrogenic CBD Injury
-Endoscopic View-

- Postoperative injury – most common
- Post-ERCP injury
- Abdominal trauma
- Ischemic
- Radiation
Endoscopic Management of the Iatrogenic CBD Injury

• Advantages
  – Immediate therapy combined with diagnostic evaluation
  – Minimally invasive
  – Not affected to further surgical, radiologic intervention

• Disadvantages
  – Need experienced endoscopist
  – Need high cost equipment / proper accessories
  – Need multiple trials with long stenting period
  – Not always successful
  – Relatively high recurrence rate

; Should be done with surgical, or radiological back-cover
Endoscopic Therapy of the Iatrogenic Biliary Tract Injury

• Principles
  – Elimination of transpapillary pressure gradient
  – To Allow the flow of bile juice into the duodenum
  – Prevent strictures

• Procedures
  – ERCP
  – EUS
ERCP for the iatrogenic Biliary Tract Injury

• Endoscopic sphincterotomy
  – Followed by stone extraction

• Endoscopic drainage
  – Biliary stent
    • 5-10F plastic stent (PS)
    • Fully covered self expandable metal stent (SEMS)
  – Nasobiliary drainage
EUS for the iatrogenic Biliary Tract Injury

- Linear EUS with needle puncture
- Transmural drainage
  - Transgastric, transduodenal
  - Stents
    - 5-10F plastic stent
    - Fully covered self expandable metal stent (SEMS)
  - Drainage catheter
## Outcomes of Endoscopic Therapy for Postoperative Biliary Leaks

<table>
<thead>
<tr>
<th>Endotherapy</th>
<th>n=105</th>
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</thead>
<tbody>
<tr>
<td>EBS + NBD</td>
<td>78 (68.0%)</td>
</tr>
<tr>
<td>EBS + stent</td>
<td>21 (20.4%)</td>
</tr>
<tr>
<td>EBS alone</td>
<td>12 (11.6%)</td>
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### Success rate
98%

### Complication rate
2%

### Mortality
0%

(EBS; endoscopic biliary sphincterotomy, NBD; nasobiliary drainage)

Common iatrogenic biliopancreatic tract injuries for endotherapy

- Benign biliary strictures
- Bile leak
- Bile leak with biloma
- Pancreatic leak
- Pancreatic leak with peripancreatic fluid collection
Endoscopic Management of Benign Biliary Stricture

• Endoscopic biliary sphincterotomy
• Dilatation
  – Bougie
  – Balloon
• Stenting - main management
  – Single plastic stent
  – Multiple plastic stents
  – Self expandable metal stent (SEMS)
Bismuth Classification of Benign Biliary Stricture

Zepeda-Gomez S, Baron TH. Nat Rev Gastroenterol Hepatol 2011;8:573
Considering Factors of Stenting for Benign Biliary Stricture (BBS)

- Long survival patients
- Short strictured segment with otherwise normal bile duct
- Wick phenomenon
  - Benign biliary stricture > Malignant biliary stricture
- Anatomic stricture ≠ Functional stricture
  - Bile duct remodeling
- High late recurrence
Results of Biliary Plastic Stenting for BBS

- Successful stent placement; 100%
- Immediate clinical success; near 100%
- Permanent resolution of stricture; 15-35%

Deviere J, et al. GIE 1990;36:96
Problems of Biliary Plastic Stenting

- Stent clogging
- Disappointing long-term results
- Stent migration
- Unclear stenting period / exchange time

Multiple Biliary Stenting for Benign Biliary Stricture

- Sequentially increasing plastic stents number
- During 1 year (3 months interval)
- 3-5 plastic stents
  - Larger cumulative diameter
- Overall clinical success rate; 62-92%
- Better long-term results than single stent
  - Progressive dilatation
  - Tissue remodeling

Catalano MF, et al. GIE 2004;60:945
Advantages of Multiple Biliary Stenting

- Slowly, gently dilatation of the fibrotic scar
- No damage to the normal bile duct mucosa
- Normal CBD below the stricture; progressively increase in diameter
- Easily removable without impairment

Costamagna, G. GIE 2008;67:455
Problems of Multiple Biliary Stenting

• Need for multiple sessions
• Technical difficulties
• How many stents?
• Stenting period?
• Which stent? (diameter, etc)
• Interval between stent placement?
• Lack of controlled, long-term follow-up data
• Poor outcomes for hilar stricture, biliary stricture by chronic pancreatitis

Retrieval, Fully Covered Metal Stent for Benign Biliary Stricture

- Longer patency than plastic stent, uncovered MS
- More effective, fewer procedures
- Safely removable stent
- Benefits of plastic stent + metal stent

- *Can be an ideal stent for benign biliary stricture*

Kaffes AJ, et al., Gastrointest Endosc 2013;78:13
Van Berkel AM, et al., Endoscopy, 2004;36:381
Cantu P, et al., Endoscopy, 2005;37:735
Retrieval, Fully Covered Metal Stent

S & G Biotech Inc, Korea
Problems of Current Fully Covered SEMS for Benign Biliary Strictures

- Migration
- Foreign body reaction; de novo stricture formation
- Reflux of duodenal contents
- Always guarantee for removal of stent?
- Stenting duration?

Kaffes AJ, et al., Gastrointest Endosc 2013;78:13
Ideal Fully Covered SEMS for Benign Biliary Strictures

- 100% stent removal rate
- Minimal foreign body reaction or tissue hyperplasia
- Preventing reflux of duodenal contents
- Preventing migration
Prevention of Stent Migration

- Conformable Biliary Stent
- Bumpy, fully covered metal stent
- HANAROSTENT biliary flap
- BONASTENT M-Intraductal
Bumpy, Fully Covered Metal Stent

(Taewoong Medical Co., Korea)

HANAROSTENT Biliary Flap

**Anti Migration:** Anchorable flaps on stent distal reduce risk of migration

**Easy Removal:** Less invasive and foldable flaps allow easy stent removal

*Park Do H, et al. Gastrointest Endosc. 2011;73:64*

(MI Tech, Co.,Ltd, Korea)
Prevention of Reflux of Duodenal Contents

• Metal stent with anti-reflux valve
• Intra-ductal deployment
Anti-Reflux Biliary Stent in Distal Malignant Biliary Strictures

Kaplan-Meier curve of cumulative patency of the stents

Anti-Reflux Biliary Stent

(Wine-glass-shaped tubular valve using silicon)

(Hanarostent, M.I. Tech., KOREA)

Kim DU, Kwon CI, et al. Dig Endosc 2013:25;60
Covered Metal Stent with Windsock Type Anti-Reflux Valve

Bare portion with flared stent proximal end

e-polytetrafluoroethylene (e-PTFE) covered body portion

Windsock type anti-reflux valve

EGIS Biliary Stent M-Valve
(S & G Biotech Inc, Korea)
EGIS Biliary Stent M-Valve
(S & G Biotech Inc, Korea)
Foreign Body Reaction of Covered SEMS in Benign Biliary Strictures

• The tip or flange of SEMS
  – potentially damage normal bile duct mucosa
  – Tissue hyperplasia at margin of stent

• Whole covering and abrupt stretching on normal CBD below stricture by SEMS
  – Inflammatory reaction by expansion, covering materials

• Abrupt dilatation of scar
  – induce inflammation, lead to stricture recurrence
New Fully Covered, Intraductal Metal Stent

BONASTENT M-Intraductal
(Standard Sci.Tech, KOREA)

Features of BONASTENT M-Intraductal (ID)

- Fully covered using silicone preventing any tissue ingrowth
- Convex margin without flange at both ends to preventing de novo stricture by tissue hyperplasia

Features of BONASTENT M-Intraductal (ID)

- Inside placement of short length stent
  - Preventing duodenal reflux
  - Minimizing the stenting effect to the normal bile duct

Insertion and Deployment of BONASTENT M-ID
Removal of BONASTENT M-ID
Anastomotic Biliary Stricture after LRLT

- Most problematic benign biliary stricture
- The location of the stricture; usually the most proximal bile duct
- Difficult to locate center of stent within the strictured bile duct segment
- Short strictured segment
51/F, Benign biliary stricture after LRLT; Total bilirubin 7.4 mg/dL
Complete Obstruction of the Bile Duct
Magnetic Compression Anastomosis by PTCS

Courtesy of Dr. Lee DK, Seoul, Korea
Endoscopic Therapy for Bile Leak

- Endoscopic biliary sphincterotomy
- Endoscopic biliary drainage
  - Biliary stent
    - 5-10F plastic stent
    - Fully covered metal stent
      - Bypass injury site/ good bilioduodenal flow
      - Prevent stricture at injured bile duct site
  - Nasobiliary drainage (ENBD)
    - Allow serial cholangiograms, and avoid repeat ERCP
Strasberg Classification of Laparoscopic Bile Duct Injury and Bile Leak

Endoscopic Therapy for Bile Leak with Biloma

- **ERCP**
  - Endoscopic biliary sphincterotomy
  - Endoscopic biliary drainage

- **Linear EUS**
  - Transmural drainage of biloma
Endoscopic Therapy for Pancreatic Leak with Peripancreatic Fluid Collection

• Endoscopic pancreatic sphincterotomy
• Endoscopic pancreatic drainage
• Transmural drainage of peripancreatic fluid collection
  – Linear EUS
Conclusions of Endoscopic Management for the Iatrogenic CBD Injury

• Primary effective
• Generally safe
• Can be repeated
• Stepwise approach
  – Classical plastic stents
  – Multiple plastic stenting
  – Fully covered SEMS
Conclusions of Endoscopic Management of the iatrogenic CBD Injury

- Surgery
- Interventional radiology
  - still as important management option in failed patients with endoscopic Tx
Features of BONASTENT M-Intraductal

- Long lasso at distal end to easy removal of stent
28, Woman

C/C  Jaundice, Abdominal pain (1 week)

P/I  Laparoscopic cholecystectomy, 2 weeks ago
## Laboratory Findings

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
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<tbody>
<tr>
<td>CBC</td>
<td>12900 - 9.8 - 286000</td>
</tr>
<tr>
<td>Total bilirubin</td>
<td>6.78 mg/dL</td>
</tr>
<tr>
<td>Direct bilirubin</td>
<td>5.28 mg/dL</td>
</tr>
<tr>
<td>AST / ALT</td>
<td>257 / 373 IU/L</td>
</tr>
<tr>
<td>ALP / rGTP</td>
<td>251 / 698 IU/L</td>
</tr>
<tr>
<td>Amylase / Lipase</td>
<td>2593 / 1880 IU/L</td>
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