Therapeutic ERCP in Infants and Children

Victor L. Fox, MD
Boston Children’s Hospital
Harvard Medical School
Rome 2013
Outline

• ERCP background
• Challenges of ERCP in children
• Therapeutic indications: biliary and pancreatic
• Case illustrations
• Infant series
ERCP in Children

• First reported by J. Waye in 1976 in 3.5 mo., 6.0 kg cholestatic male infant
  – Olympus JF-B duodenoscope
  – Partial technical success but incorrect diagnosis

• Current utilization has shifted from diagnostic to therapeutic applications

• Indications, technical outcomes, and complication rates similar to adult patients

Waye JD. Am J Gastroenterol 1976;65: 461-3
ERCP: Children vs Adults

- Varadarajulu et al 2004—retrospective case-controlled two center study
  - 116 pediatric and adult cases matched for indications and procedural complexity

<table>
<thead>
<tr>
<th></th>
<th>Child</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, median, y</td>
<td>8.1</td>
<td>49.7</td>
</tr>
<tr>
<td>Technical success, %</td>
<td>97.5</td>
<td>98</td>
</tr>
<tr>
<td>Complication rate, %</td>
<td>3.4</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Pediatric ERCP Series

• Largest ERCP series: Cheng et al 2005
  – 329 procedures in 245 children, 9 year interval
  – Selective cannulation successful = 322 (97.9%)
  – Therapeutic = 235 (71.4%)
    • sphincterotomy = 122, dilation = 26, stent = 30, stone/sludge removal = 32
  – Complications = 37 (11.2%)
    • Pancreatitis = 31, bleeding = 5/122 (4.1%), cholangitis = 1
  – 12 infants ≤ 2 yrs old
    • No details provided about these procedures

Pediatric ERCP Series

• Recent large ERCP series: Otto et al 2011
  – 231 procedures in 167 children, 16 year interval
  – Therapeutic = 159 (69%)
    • Sphincterotomy = 96, stone removal = 55, stent = 52
  – Complications = 11 (4.8%)
    • Pancreatitis = 7, bleeding after sphincterotomy = 2/96 (2.1%)
  – 18 infants ≤ 2 yrs
    • No details provided about these procedures

Otto et al. Surg Endosc 2011;8:2536-40
Therapeutic ERCP: Infants

• Few case reports
  – 1989 Guelrud--- bile duct stent after ES in infant (2 yrs) with malignant biliary obstruction
  – 1994 Guelrud--- ES in 6 mo. infant for choledocholithiasis
  – 1996 Wilkinson--- ES in 2 mo. infant with choledocholithiasis
  – 1998 Tarnasky--- ES in three children (0.5, 0.6, and 1.2 yrs) for choledocholithiasis
Challenges to Therapeutic Pediatric ERCP
Size Matters
Problems

• Equipment
  – Ultraslim duodenoscopes are designed for adults with altered anatomy, not designed for children
    • Insertion tube too long, operating channel too narrow for many accessories
    • Expensive to purchase and maintain

• Personnel
  – Limited experience and willingness by adult endoscopists

• Training
  – No formal training opportunities for pediatric endoscopists and small case volume
Pediatric Therapeutic Indications
Biliary and Pancreatic

- Removal of stones or sludge, or protein plugs
- Dilation of strictures
  - Congenital and acquired
- Diversion of biliary or pancreatic leaks
  - Accidental trauma or surgical injury
- Improve drainage by sphincterotomy
  - Papillary stenosis, APBU, SOD, choledochocoele
- Rarely needed for malignant conditions
## Duodenoscopes

<table>
<thead>
<tr>
<th>Olympus</th>
<th>PJF 160</th>
<th>JF 100/140F</th>
<th>TJF 160/Q180V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel (mm)</td>
<td>2.0</td>
<td>3.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Tip O.D. (mm)</td>
<td>7.5</td>
<td>12.5/12.0</td>
<td>13.2/13.7</td>
</tr>
</tbody>
</table>
Accessories

(Images Courtesy of Wilson-Cook)
Case Examples
8 yr male with Hgb SS, acute abdominal pain, jaundice
Sphinctertomy/Balloon Extraction
Choledocholithiasis

19 month male infant

Adolescent female
5 wk, 3.9 kg male: acholic stool and jaundice
23 mo, 12.5 kg male: Langerhans cell histiocytosis and hepatic duct stone

Temporary stent drainage
Stone removal
Chronic Pancreatitis

- Pancreatic sphincterotomy
- Stone extraction
- Stricture dilation

18 yr female with hereditary pancreatitis
3.5 yr female with intermittent abdominal pain for 6 months

- Elevated AST, ALT, Alk phos, nl bilirubin
- Abnl US and MRCP
  - Enlarged GB and dilated bile ducts
  - Suspected stricture at distal CBD
Choledochoochocele (type III CDC)
Sphincter of Oddi Dysmotility

- 12 yr female with intermittent abd pain x 8 mo.
- Abnl US and MRCP with dilated bile duct
- Normal labs
  - Type II SOD*
- Pain resolved after temporary stent placement and final sphincterotomy

* Geenen-Hogan classification
Anomalous Pancreatobiliary Union (APBU)

Relapsing pain, cholestasis, and pancreatitis

Sphincterotomy and balloon dilation
“Double duct sign” in 10 yr male with 6 wks of abd pain, jaundice, mild lipase elevation

? Idiopathic fibrosing pancreatitis
Immediate symptom relief after stent
Follow-up

• Symptoms resolved, labs normalized
• Stent removed after 2 mo
• Repeat MRCP after 6 mo
  – CBC stenosis resolved
  – PD improved
2 yr male, 5 days of jaundice, acholic stool, pruritis, mildly elevated lipase

Obstructed duct, stented  Stent removed 2 months later
17 mo female, acute jaundice, dilated hepatic ducts

Non-excreting HIDA scan

Failed operative cholangiogram
Wire-guided dilation of hilar stricture
Balloon catheter dilation
Stenting for Bile Leak

Stump leak

10 Fr x 2 cm stent

1 month later
Infant Series
ERCP in Infants (< 2 yrs old)  
Children’s Hospital 2006 - 2011  
(12.7% of all ERCP)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. procedures</td>
<td>22</td>
</tr>
<tr>
<td>No. patients</td>
<td>17</td>
</tr>
<tr>
<td>No. patients &lt; 1 yr old</td>
<td>12 (70%)</td>
</tr>
<tr>
<td>Age wk, median (range)</td>
<td>50 (5–103)</td>
</tr>
<tr>
<td>Weight kg, median (range)</td>
<td>8.3 (3.9-14)</td>
</tr>
<tr>
<td>Male gender</td>
<td>59%</td>
</tr>
</tbody>
</table>
## Indications for Therapy

<table>
<thead>
<tr>
<th>Condition</th>
<th>No. Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biliary (n = 18)</strong></td>
<td></td>
</tr>
<tr>
<td>Choledocholithiasis</td>
<td>9</td>
</tr>
<tr>
<td>Stricture</td>
<td>6</td>
</tr>
<tr>
<td>Leak</td>
<td>2</td>
</tr>
<tr>
<td>Cholestasis-related pruritis</td>
<td>1</td>
</tr>
<tr>
<td><strong>Pancreatic (n = 2)</strong></td>
<td></td>
</tr>
<tr>
<td>Leak</td>
<td>1</td>
</tr>
<tr>
<td>Stone</td>
<td>1</td>
</tr>
</tbody>
</table>
Comorbid Conditions

- Hepatoblastoma = 4
  - Partial hepatectomy (2)
  - Liver transplantation (2)
- Kidney transplantation = 1
- Complex congenital heart disease = 2
- Langerhans cell histiocytosis = 1
- Respiratory insufficiency = 1
Therapeutic Interventions

- Procedures = 20/22 (90.9%)
- Patients = 16/17 (94.1%)
- Successful selective duct cannulation = 18/20 (90%)
- Type of intervention
  - Sphincterotomy = 8
  - Stone/sludge removal or drainage = 11
  - Dilation and stent management = 4
- Technical success
  - 15/20 (75%) procedures
Technical Failures (n = 5)

1. Biliary leak
   - Unable to advance 5 Fr stent
   - Successful repeat with 3 Fr stent

2. Pruritis from progressive familial intrahepatic cholestasis (PFIC)
   - Failed biliary but successful pancreatic cannulation

3. Choledocholithiasis
   - Elevator broke during attempted sphincterotomy
Technical Failures

4. Biliary anastomotic stricture
   - **Severe fibrosis** prevented advancement of dilation catheter over successfully placed wire guide
   - PTC approach also failed

5. Pancreatic leak
   - Failed pancreatic cannulation for stent
   - Repeat diagnostic cannulation successful when fluid collections resolved by percutaneous drainage
Immediate Clinical Outcomes

- Clinical improvement = 11/16 (69%) patients
  - Stone/sludge removed and surgery avoided
    • 7 of 8 patients
  - reduced duct leakage
    • 1 of 3 patients
  - Relieved stricture-related obstruction
    • 3 of 4 patients
Complications

- Pancreatitis: 2/20 (10%) mild
- Hemorrhage: none
- Perforation: none
- Infection: none
Follow-up after ES and stone removal

• 7 patients
• Duration follow-up
  – Mean 25.8 mo
  – Range 3 to 57 mo
• No recurrent pain, jaundice, new or residual stones
Conclusion

• Therapeutic ERCP can be performed safely with substantial technical success and immediate clinical benefit in children and infants
• Technical and clinical outcomes are comparable to those in adult patients
• Cholecystectomy may be unnecessary after sphincterotomy and stone removal in infants
• Other surgeries may be avoided
  – CBD exploration or resection, laparotomy, operative cystogastrostomy
Thank you!