Current Indications & Use for EUS in 2015

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Objectives
- Background
- Common indications
- Emerging indications
- Outcome
- Complication
- Take home points
Current Indications for EUS in 2015

Background
- Introduced in USA early 80’s
- Described as diagnostic procedure
  - Luminal GI tract
  - Pancreatobiliary region
- Became a therapeutic tool for both academicians and large private practice groups

Background
- Late 90’s advanced endoscopy (AE) programs
  - EUS/ERCP (4th year)
- In USA:
  - 58 AE Programs
  - 66 positions available annually
  - Not accredited by ACGME
  - Mostly restricted to national graduates
Current Indications for EUS in 2015

- Background
  - Most fellows require >400 procedures for competency
    - Diagnostic
    - Staging
    - EUS-FNA
    - EUS FNI (celiac plexus block/neurolysis)

Current Indications for EUS in 2015

- Common indications
  - Subepithelial mass
  - Chronic pancreatitis
  - Biliary lithiasis
  - Staging luminal & pancreaticobiliary cancers
  - Tissue acquisition (masses, cysts, LNs)
  - Celiac plexus block/neurolysis
Current Indications for EUS in 2015

Subepithelial masses

Current Indications for EUS in 2015

• Subepithelial lesions
  • Discriminate from extrinsic compressions
  • Identify layer of origin
  • Evaluate echotexture
    • Solid
    • Cystic
    • Vascular
  • Guide treatment vs. observation
Current Indications for EUS in 2015

Subepithelial masses

GIST
Leiomyoma
Lipoma
Schwannoma
Varices
Duplication cysts
Lymphangioma

Carcinoids
Pancreatic rest
Granular cell tumors
Glomus tumor
Lymphoma
Endometriosis
Brunner gland hyperplasia
### Current Indications for EUS in 2015

<table>
<thead>
<tr>
<th>Tumor</th>
<th>Marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIST</td>
<td>CD-117 (c-kit), CD-34</td>
</tr>
<tr>
<td>Smooth muscle tumor</td>
<td>Smooth muscle actin</td>
</tr>
<tr>
<td></td>
<td>Desmin</td>
</tr>
<tr>
<td>Schwannoma</td>
<td>S-100</td>
</tr>
<tr>
<td>Glomus tumor</td>
<td>Smooth muscle actin</td>
</tr>
<tr>
<td></td>
<td>Vimentin</td>
</tr>
</tbody>
</table>

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**Proposed Approach for Defining Risk of Aggressive Behavior in GIST**

<table>
<thead>
<tr>
<th>Risk</th>
<th>Size</th>
<th>Mitotic Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>&lt;2 cm</td>
<td>&lt;5/50 HPF</td>
</tr>
<tr>
<td>Low</td>
<td>2-5 cm</td>
<td>&lt;5/50 HPF</td>
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<tr>
<td>Intermediate</td>
<td>&lt;5 cm</td>
<td>6-10/50 HPF</td>
</tr>
<tr>
<td></td>
<td>5-10 cm</td>
<td>&lt;5/50 HPF</td>
</tr>
<tr>
<td>High</td>
<td>&gt;5 cm</td>
<td>&gt;5/50 HPF</td>
</tr>
<tr>
<td></td>
<td>&gt;10 cm</td>
<td>Any mitotic rate</td>
</tr>
<tr>
<td></td>
<td>Any size</td>
<td>&gt;10/50 HPF</td>
</tr>
</tbody>
</table>
Current Indications for EUS in 2015

Subepithelial tumors: FNA
• Unlikely to affect GIST < 2 cm
• Not needed for > 2 cm → Lap resection safe
• Appropriate for unresectable GIST for diagnosis and c-kit determination

Chronic pancreatitis
• Still dependent on number of criteria present
  • Hyperechoic foci
  • Hyperechoic strands
  • Lobularity
  • Cyst
  • Calcification
  • Main duct dilation
  • Branch duct dilation
  • Main duct irregularity
  • Hyperechoic ductal margin
  • Atrophy
Current Indications for EUS in 2015

- Chronic pancreatitis
  - Still dependent on number of criteria present
    - Hyperechoic foci
    - Hyperechoic strands
    - Lobularity
    - Cyst
    - Calcification
    - Main duct dilation
    - Branch duct dilation
    - Main duct irregularity
    - Hyperechoic ductal margin
    - Atrophy

The threshold for diagnosing CP can be varied according to the number of criteria used (≥3, ≥4, or ≥5 criteria)

EUS sensitivity and specificity compared with other modalities depend upon the threshold that is chosen

- If a low threshold is used (1–2 criteria)
  - Sensitivity & NPV ↑, but specificity & PPV ↓
- If a higher threshold is used (>5 criteria)
  - Sensitivity & NPV ↓, but specificity ↑

Current Indications for EUS in 2015

- Tumor staging
  - Established for cancer staging of
    - Esophagus
    - Pancreas
    - Rectum

Current Indications for EUS in 2015

- Tissue acquisition
  - Needles
    - Manufacturers
  - Gauges
  - Techniques
    - Use of stylet
    - Use of suction
  - Presence of cytopathologist on site
  - Endosonographer experience

Current Indications for EUS in 2015

EUS-FNA

• Presence of cytotechnologist/pathologist
• To reduce the rate of nondiagnostic specimens
• On site evaluation ↑ diagnostic yield by 10%-15%\(^1\)
  • 20% nondiagnostic specimens if cytotechnologist not present\(^2\)

\(^1\)Erickson, Sayage Rabie et al. *Gastrointest Endosc.* 2000;51:184-90
\(^2\)Savoy, Raimondo et al. *Gastrointest Endosc.* 2007;65:953-7
Current Indications for EUS in 2015

Endoscopist's skills

- Pancreatic masses (n=300 over 3 yrs)
  - 150 EUS-FNA are necessary to become very proficient
  - No difference in overall complications
  - Decrease number of needle passes

Eloubeidi & Tamhane. EUS-guided FNA of solid pancreatic masses: A learning curve with 300 consecutive procedures. Gastrointest Endosc 2005;61:700-8

Celiac plexus block (CPB) or neurolysis (CPN) have been performed for >100 yrs

Celiac plexus consists of

- Variable number of ganglia
- Anterior to the diaphragmatic crurae
- T12-L2 vertebrae
Current Indications for EUS in 2015

- Alleviating pancreatic pain performed by
  - US (anterior approach)
  - Fluoroscopy
  - CT scan (bilateral posterior approach)

Current Indications for EUS in 2015

- CPN/CPB
  - EUS curvilinear scope
  - Routine meds for conscious sedation
  - Needle (22-19 gauge)
  - Pre procedure patients’ hydration
  - ? Antibiotic use for CPB (steroids)

<table>
<thead>
<tr>
<th>CPB</th>
<th>CPN</th>
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<tbody>
<tr>
<td>0.25% Bupivacaine</td>
<td>0.25% Bupivacaine</td>
</tr>
<tr>
<td>(20 ml)</td>
<td>(6 ml)</td>
</tr>
<tr>
<td>80 mg Triamcinolone</td>
<td>Absolute alcohol</td>
</tr>
<tr>
<td></td>
<td>(20 ml)</td>
</tr>
</tbody>
</table>
Current Indications for EUS in 2015

Emerging indications
- EUS elastography
- EUS-guided biliary drainage
- EUS guided confocal of pancreas cysts
- EUS-guided pseudocyst drainage
- EUS-guided necrosectomy
- EUS-guided vascular therapy
Current Indications for EUS in 2015

EUS elastography

- Relatively new technique to evaluate
  - Stiffness or rigidity of a given solid tissue relative to that of adjacent normal tissue by measuring the strain or displacement generated in response to compression or vibration
  - Echoendoscope connected to workstation with appropriate software


Current Indications for EUS in 2015

EUS elastography

- N=104 (pancreatic cancer, chronic pancreatitis, and other pancreatic tumors)
  - Diagnostic utility modest
  - May only supplement rather than supplant the role of pancreatic tissue sampling in the future

Current Indications for EUS in 2015

EUS elastography
- Used to distinguish benign from malignant lymph nodes, benign from malignant pancreatic masses
- For diagnosis of solid pancreatic masses
  - Sensitivity from 85% to 100%
  - Specificity from 33% to 93%


Current Indications for EUS in 2015

EUS-guided biliary drainage
- Emerging as an alternative to a failed ERCP
  - Transmural drainage (hepatico-gastrostomy or choledocho-duodenostomy), a rendezvous procedure or an antegrade approach
  - EUS guided transluminal drainage (EUS-TLD) is achieved by bile duct puncture from the stomach or the duodenum using EUS-FNA needle

Current Indications for EUS in 2015

- EUS-guided biliary drainage
  - After cholangiogram
  - Guidewire is placed into the biliary system
  - Tract dilated followed by insertion of stent to achieve drainage of biliary system into the stomach or the duodenum
  - Duodenal station to achieve access into the common bile duct
  - Gastric station to access to the left lobe intrahepatic biliary radicals


- Feasibility of needle-based confocal laser scanning endomicroscopy (nCLE) for in vivo histology in a porcine model

Current Indications for EUS in 2015

- EUS guided confocal of pancreas cysts
  - Feasibility study (3 Institutions, 18 pts)
  - Data obtained in 17/18 pts
    - Good images obtained in 10/17 pts
    - Challenging in 6/18 pts

Position of the probe

Transduodenal approach

2 cases of pancreatitis

Current Indications for EUS in 2015

EUS guided confocal of pancreas cysts
- Superficial vascular network pattern on nCLE with dense and subepithelial capillary vascularization only seen in SCA
  - Accuracy 87%
  - Sensitivity 69%
  - Specificity 100%
  - Positive predictive value 100%
  - Negative predictive value 82%
  - Interobserver agreement \( \kappa = 0.77 \)


Current Indications for EUS in 2015

EUS guided confocal of pancreas cysts
- 15 de-identified nCLE video clips of PCLs
  - 6 interventional endoscopists
  - 5 institutions
- 6 variables: presence of vessels, villi, dark clumps, reticular pattern, acinar cells pattern and debris
- Interobserver agreement ranged from “poor” to “fair”: \( k = 0.04 - 0.22 \)
- Need to identify and validate imaging criteria to determine whether nCLE has diagnostic value for pancreatic pathology

Current Indications for EUS in 2015

EUS-guided pseudocyst drainage
- Linear scope with Doppler
- 19 gauge needle to access the collection
- A guidewire is coiled into the cyst cavity and the tract is dilated
  - Single or multiple plastic stents
  - Fully covered self-expanding metallic stent


Current Indications for EUS in 2015

EUS-guided necrosectomy
- Associated with high morbidity and mortality
- Labor intensive
- Resource consuming
- Lacks technique-specific devices

Current Indications for EUS in 2015

- **EUS-guided necrosectomy**
  - In the multicenter GEPARD study
  - Procedure-related adverse event rate 26%
    - 2.1% mortality
    - 5.3% perforation
    - 14% bleeding
    - Clinically significant air embolism in two patients

  Seifert et al. Transluminal endoscopic necrosectomy after acute pancreatitis: a multicentre study with long-term follow-up (the GEPARD Study). Gut 2009;58:1260-1266

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Current Indications for EUS in 2015

- **EUS-guided vascular therapy**
  - Non variceal bleeding
  - Dieulafoy’s lesions
  - Peptic ulcers
  - GIST
  - Variceal bleeding
  - Esophageal
  - Gastric

Current Indications for EUS in 2015

- EUS-guided vascular therapy
  - Stainless steel coils
  - 2-octyl-cyanoacrylate (glue)


Current Indications for EUS in 2015

- Complications
  - EUS-biliary drainage
    - Bile leakage 5.2%
  - Stent misplacement 3.1%
  - Bleeding 2.1%
  - Pneumoperitoneum 1%

Current Indications for EUS in 2015

Complications
- EUS-pancreatic duct drainage
  - Pancreatitis
  - Bleeding
  - Perforation
  - Stent migration
- Overall complication rates
  - Ranging from 0 to 52%


<table>
<thead>
<tr>
<th>Procedure</th>
<th>Ia</th>
<th>Ib</th>
<th>IIa</th>
<th>III</th>
<th>IV</th>
<th>Total</th>
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<tr>
<td>EUS pancreatic fluid collections</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>16</td>
<td>42</td>
<td>84</td>
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<td>EUS necrosectomy</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>3</td>
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<tr>
<td>EUS-biliary drainage</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>37</td>
<td>40</td>
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<td>0</td>
<td>0</td>
<td>9</td>
<td>6</td>
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<td>EUS-gallbladder drainage</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>2</td>
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<tr>
<td>EUS-abd &amp; pelvic collections</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>7</td>
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<tr>
<td>EUS-ceilac block/neurolysis</td>
<td>4</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>16</td>
<td>19</td>
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<td>EUS-ethanol ablation</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>13</td>
<td>9</td>
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<td>EUS-tumor ablation</td>
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<td>4</td>
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<td>EUS-fiducial placement</td>
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<td>26</td>
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<td>EUS-vascular intervention</td>
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<td>1</td>
<td>0</td>
<td>2</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6</td>
<td>17</td>
<td>1</td>
<td>51</td>
<td>165</td>
<td>141</td>
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### Current Indications for EUS in 2015

<table>
<thead>
<tr>
<th>Type of procedure</th>
<th>Studies</th>
<th>Patients n=</th>
<th>Clinical Success (%)</th>
<th>Recurrence %</th>
<th>Complications %</th>
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</thead>
<tbody>
<tr>
<td>EUS pancreatic fluid collections</td>
<td>55</td>
<td>1867</td>
<td>90 (69-100)</td>
<td>8 (0-23)</td>
<td>17 (0-52)</td>
</tr>
<tr>
<td>EUS necrosectomy</td>
<td>16</td>
<td>283</td>
<td>88 (50-100)</td>
<td>7 (0-20)</td>
<td>28 (0-46)</td>
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<tr>
<td>EUS-biliary drainage</td>
<td>27</td>
<td>1088</td>
<td>87 (70-100)</td>
<td>-</td>
<td>29 (3-77)</td>
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<tr>
<td>EUS-pancreatic duct drainage</td>
<td>9</td>
<td>205</td>
<td>74 (53-100)</td>
<td>-</td>
<td>20 (7-55)</td>
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<tr>
<td>EUS-gallbladder drainage</td>
<td>15</td>
<td>97</td>
<td>100 (85-100)</td>
<td>-</td>
<td>0 (0-37)</td>
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<tr>
<td>EUS-abd &amp; pelvic collections</td>
<td>20</td>
<td>120</td>
<td>100 (75-100)</td>
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<td>0 (0-35)</td>
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<td>EUS-ceeliac block/neurolysis</td>
<td>23</td>
<td>1327</td>
<td>72 (46-90)</td>
<td>-</td>
<td>(80 minor)</td>
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<tr>
<td>EUS-ethanol ablation (cystic)</td>
<td>8</td>
<td>169</td>
<td>60 (33-79)</td>
<td>?</td>
<td>(4 AP)</td>
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<tr>
<td>EUS-fiducial placement</td>
<td>13</td>
<td>278</td>
<td>100 (85-100)</td>
<td>-</td>
<td>0</td>
</tr>
</tbody>
</table>


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### Current Indications for EUS in 2015

- **Take home points**
  - Confirmed for common indications
  - Expanding in emergent indications
  - Significant clinical success and potential
  - Questions remain regarding training
  - Reported (& unreported) complications
  - Quality and improvement measures
  - Minimize patients’ risks